

# Sexual well being in parkinsonian patients after deep brain stimulation of the subthalamic nucleus

L Castelli, P Perozzo, M L Genesia, E Torre, M Pesare, A Cinquepalmi, M Lanotte, B Bergamasco, L Lopiano

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See end of article for authors' affiliations

Correspondence to: Castelli Lorys, Department of Psychology, Centre for Cognitive Science, Via Po 14, 10123 Turin, Italy; castelli@psych.unito.it

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**Objectives:** To evaluate changes in sexual well being in a group of patients with Parkinson's disease following deep brain stimulation (DBS) of the subthalamic nucleus (STN).

**Methods:** 31 consecutive patients with Parkinson's disease (21 men and 10 women), bilaterally implanted for DBS of STN, were evaluated one month before and 9–12 months after surgery. Sexual functioning was assessed using a reduced form of the Gollombok Rust inventory of sexual satisfaction (GRISS). Depression (Beck depression inventory) and anxiety (STAI-X1/X2) were also evaluated. Relations between sexual functioning and modifications in the severity of disease (Hoehn and Yahr stage), reduction in levodopa equivalent daily dosage (LEDD), age, and duration of disease were analysed.

**Results:** While no modifications were found in female patients, male patients reported slightly but significantly more satisfaction with their sexual life after DBS of STN. When only male patients under 60 years old were considered, a greater improvement in sexual functioning was found, though still small. Modifications in depressive symptoms and anxiety, as well as duration of the disease, reduction in LEDD, and improvement in the severity of disease, showed no relation with changes in sexual functioning after DBS of STN.

**Conclusions:** DBS of STN appears to affect sexual functioning in a small but positive way. Male patients with Parkinson's disease, especially when under 60, appeared more satisfied with their sexual well being over a short term follow up period.

Deep brain stimulation (DBS) of the subthalamic nucleus (STN) is an effective therapeutic option in the treatment of advanced Parkinson's disease.<sup>1,2</sup> Several studies have shown its effectiveness on the cardinal symptoms of the disease (rigidity, bradykinesia, and tremor), the significant reduction in levodopa-equivalent daily dosage (LEDD), and the improvement in drug induced dyskinesias after surgery.<sup>3–6</sup> Both the neuropsychological profile<sup>7–11</sup> and the psychological and behavioural aspects<sup>12–14</sup> have been investigated after STN DBS in patients with Parkinson's disease, but its effect on sexual behaviour has never been investigated.

In general, sexual function in parkinsonian patients has been examined very little.<sup>15</sup> Brown *et al* suggested two possible explanations for this general lack of interest.<sup>16</sup> First, Parkinson's disease is not generally assumed to be associated with physiological dysfunction or neuronal damage that would interfere with sexual response. As reported by Brown *et al*, autonomic dysfunction affecting the urogenital system may, however, be observed in some patients with idiopathic Parkinson's disease. Second, there may be an implicit assumption that these patients, being generally middle aged or elderly, are less interested in sex, in spite of the possibly unchanged role of sexual well being in the elderly.<sup>17</sup> Moreover, this assumption ignores the existence of patients affected by Parkinson's disease in early or mid-adult life.

Levodopa, as well as dopamine agonists, are usually reported to increase sexual well being,<sup>18,19</sup> even though some antiparkinsonian drugs—for example, bromocriptine—may also lead to a reduction in sexual function.<sup>20,21</sup> Lipe *et al*<sup>22</sup> addressed this question by comparing groups of married men with Parkinson's disease and with arthritis, a disease that does not affect the nervous system. They found a similar

pattern of sexual functioning in the two groups, suggesting that Parkinson's disease of itself and the dopaminergic drug treatment are not the most important determinants of sexual functioning. Age, severity of disease, and depression (often present in Parkinson's disease) seemed to be the most important predictors of sexual well being in both groups. Other studies showed that age and severity of disease were determinant factors, while pharmacological treatment was not.<sup>23,24</sup>

Some investigators<sup>25</sup> have highlighted the relevance of depression for a subjective sense of sexual dissatisfaction, comparing young patients with Parkinson's disease with healthy controls. Dissatisfied patients were found to be more depressed than satisfied patients, especially among a male cohort. While the frequency of intercourse did not differ from that of a control group, depressed and unemployed patients were more often dissatisfied with their sexual well being. Another study compared sexual well being in parkinsonian patients and healthy controls, taking into account only women.<sup>26</sup> The investigators found that the women with Parkinson's disease were more likely to be dissatisfied with their sexual and affective relationships. In this case too, women with Parkinson's disease were found to be more depressed than controls, and depression was positively correlated with sexual dysfunction.

Recently, Romito *et al* evaluated the long term follow up of 22 patients submitted to STN DBS.<sup>6</sup> In four patients they reported a transient increase in sexual well being during the

**Abbreviations:** BDI, Beck depression inventory; DBS, deep brain stimulation; GRISS, Gollombok Rust inventory of sexual satisfaction; H-Y, Hoehn and Yahr stage; LEDD, levodopa equivalent daily dosage; SFI, sexual functioning inventory; STAI, state-trait anxiety inventory; STN, subthalamic nucleus

first months after surgery, and in two of them maniac psychosis was also present. Nevertheless, the question of the general impact of the surgical procedure on sexual well being was not addressed.

Our aim in this study was to evaluate whether STN DBS can modify different aspects of sexual well being in a group of patients with idiopathic Parkinson's disease submitted to this surgical procedure.

## METHODS

### Subjects

Thirty one consecutive patients with Parkinson's disease (21 men, 10 women), bilaterally implanted for STN DBS, were evaluated one month before and nine to 12 months after surgery. The severity of disease was assessed by Hoehn and Yahr stage (H-Y).<sup>27</sup> All patients were married at the time of the evaluation. There was no evidence of autonomic urogenital dysfunction on interview or physical examination.

The principal inclusion criteria for surgical treatment were the diagnosis of idiopathic Parkinson's disease, the presence of severe motor fluctuations and drug related dyskinesias, the absence of marked atrophy or focal abnormalities on brain magnetic resonance imaging (MRI), and the absence of dementia, major depression, or psychosis.<sup>28</sup> All patients were submitted to DBS of STN following the surgical procedure previously described.<sup>29</sup> Postoperative brain MRI confirmed the positioning of the stimulating electrodes in the subthalamic region and excluded surgical complications. None of the 31 patients reported postoperative deterioration in cognitive or relevant cognitive changes such as disinhibition.

### Assessment of sexual function

All the patients completed a reduced form of the Gollombok Rust inventory of sexual satisfaction (GRISS),<sup>30</sup> translated into Italian. The original version of the inventory could not be used as many patients refused to complete it for religious or sociocultural reasons. Thus the items that appeared most problematic for the patients were eliminated from the original version. The reduced version of the GRISS used in this study was called the sexual functioning inventory (SFI).

The same subscales of the original version (seven for each sex) were used, thus reducing the number of items. No new item was added to the original version. The SFI was structured as a 15 item scale rated from 1 to 4, evaluating sexual functioning. The highest possible total score was 60, indicating the most sexual problems; the lowest possible total score was 15. Two different forms were used, for male and female subjects (see the appendix).

All the patients were evaluated at two different times: in the med-on condition (daily dopaminergic dosage) one month before surgery, and in the stim-on/med-on condition

**Table 1** Clinical characteristics of the patients with Parkinson's disease enrolled in the study

Variable	Men (n = 21)	Women (n = 10)	Total
Age (years)	62.3 (4.5)	60.3 (4.6)	61.7 (4.6)
Duration of disease (years)	16.62 (5.14)	17.6 (4.3)	16.9 (4.8)
LEDD (mg/d)			
Before surgery	1074.1 (314.4)	725.7 (299.7)	961.7 (346.8)
After surgery	309.0 (196.8)	303.5 (265.2)	307.2 (216.7)
Hoehn and Yahr stage			
Before surgery	4	4	4
After surgery	2.5	3	2.5

Values are mean (SD).  
LEDD, levodopa equivalent daily dosage.

nine to 12 months after surgery. The postoperative med-on condition referred to the particular daily dosage of anti-parkinsonian drugs which, together with the therapeutic variables of the STN stimulation, allowed the patients to obtain the best clinical benefit.

### Psychological assessment

Depression and anxiety were evaluated using the Beck depression inventory (BDI) and the state-trait anxiety inventory (STAI-X1/X2), administered before and after surgery at the same time as sexual function assessment. The BDI is a 21 item self rated scale showing cognitive, behavioural, and somatic aspects of depression.<sup>31</sup> STAI is a 40 item self rated scale evaluating anxiety as a reaction to episodic stress conditions (STAI-X1) and as a predisposing factor for anxious behaviour (STAI-X2).<sup>32</sup> Evaluation was also made before and after surgery at the same time as sexual function assessment.

### Statistical analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS). Preoperative *v* postoperative test scores were compared using the non-parametric Wilcoxon test (two tailed). Comparisons between different subgroups were made using the Mann-Whitney test. Bonferroni's correction was employed when we compared preoperative *v* postoperative test scores within subgroups. The Spearman rank correlation coefficient was used to evaluate correlations between the sexual functioning scores, psychological tests, and clinical variables. A probability (p) value of <0.05 was considered statistically significant.

**Table 2** Sexual functioning inventory for the different subscales before and after surgery

	Men (n = 21)		Women (n = 10)	
	Before surgery	After surgery	Before surgery	After surgery
Infrequency	5.7 (1.7)	5.6 (1.4)	5.9 (1.1)	6.0 (0.9)
Non-communication	4.5 (1.6)	4.5 (1.1)	5.0 (1.0)	5.1 (1.1)
Dissatisfaction	6.2 (2.2)	5.1 (1.5)*	5.8 (1.7)	5.6 (1.6)
Avoidance	4.3 (1.8)	4.0 (1.5)	5.5 (1.3)	5.4 (1.5)
Non-sensuality	2.9 (1.0)	2.8 (1.0)	3.4 (1.1)	3.2 (1.3)
Premature ejaculation	2.9 (0.9)	2.9 (0.8)		
Impotence	1.9 (0.9)	1.8 (0.7)		
Vaginismus			2.8 (0.9)	2.2 (1.1)
Anorgasmia			2.5 (1.0)	2.6 (0.9)
<b>Total score</b>	<b>30.3 (7.8)</b>	<b>28.6 (4.9)</b>	<b>33.1 (3.3)</b>	<b>32.0 (3.9)</b>

Values are mean (SD).  
\*p<0.05 *v* preoperative score.

**Table 3** Results of the sexual functioning inventory for subgroups subdivided according to age at the time of the surgical procedure

	Men aged $\leq 60$ years (n=7)		Men aged $>60$ years (n=14)	
	Before surgery	After surgery	Before surgery	After surgery
Infrequency	6.7 (1.1)	5.8 (1.2) *	5.2 (1.8)	5.5 (1.5)
Non-communication	5.5 (1.6)	4.5 (0.5)	4.0 (1.4)	4.5 (1.4)
Dissatisfaction	6.7 (1.4)	5.1 (1.9)†	6.0 (2.6)	5.2 (1.3)
Avoidance	5.2 (1.9)	3.2 (0.4)†	3.9 (1.6)	4.3 (1.7)
Non-sensuality	3.1 (1.2)	2.8 (1.0)	2.7 (1.0)	2.7 (1.0)
Premature ejaculation	2.7 (1.2)	2.7 (0.9)	3.0 (0.8)	3.1 (0.8)
Impotence	2.4 (0.7)	2.1 (0.9)	1.7 (0.9)	1.7 (0.7)
<b>Total score</b>	<b>34.7 (5.5)</b>	<b>28.0 (4.3)*</b>	<b>28.1 (8.1)</b>	<b>29.0 (5.3)</b>

Values are mean (SD).

\* $p < 0.025$  (following Bonferroni's correction) v preoperative score.

† $p < 0.05$  (NS following Bonferroni's correction) v preoperative score.

## RESULTS

### Characteristics of the patients

Table 1 shows the principal characteristics of the patients. A significant reduction in dopaminergic treatment ( $z = -4.70$ ;  $p = 0.000$ ) and a decrease in the severity of the disease (H-Y scale) ( $z = -4.71$ ;  $p = 0.000$ ) were found after surgery.

### Sexual function assessment

Table 2 shows the SFI scores of male and female patients. The total score was lower for both groups after surgery, though the difference compared with the preoperative period was not significant for either male ( $z = -0.65$ ; NS) or female patients ( $z = -0.72$ ; NS).

Male patients showed a significant improvement on the dissatisfaction subscale ( $z = -2.27$ ;  $p = 0.023$ ) and this was the only significant difference observed. The other subscales remained unchanged or showed few positive changes in the postoperative period. In the female group, no significant differences were observed; in this case, the scores remained substantially unchanged or showed little improvement.

Further analysis was made to evaluate a possible influence of disease duration and the patient's age on sexual behaviour after surgery. The female group was not considered in this analysis because of the small size of the sample and because no subscales were significant in the first analysis. Male patients were divided into two groups on the basis of disease duration ( $\leq$  and  $>15$  years) and age ( $\leq$  and  $>60$  years). The same statistical analysis previously described was run on each subgroup.

The results showed that disease duration was not a discriminating factor. Indeed, no significant differences were found between preoperative and postoperative scores in either subgroup ( $\leq$  and  $>15$  years). On the other hand, differences were found when the sample was subdivided according to age (table 3). Patients over 60 showed no significant change, while patients  $\leq 60$  showed a general and significant improvement in SFI scores. In this subgroup the total SFI score decreased significantly in the postoperative period ( $z = -2.37$ ;  $p = 0.018$ ). Analysing the different

subscales, a significant improvement was found in infrequency score ( $z = -2.45$ ;  $p = 0.014$ ), while dissatisfaction score ( $z = -2.03$ ;  $p = 0.042$ ; NS following Bonferroni's correction) and avoidance score ( $z = -2.03$ ;  $p = 0.042$ ; NS following Bonferroni's correction) showed a trend to positive changes. Comparisons made between the two male groups (age  $\leq 60$  v  $>60$  years), first in the preoperative period and then in the postoperative period, allowed us to obtain further data. In the preoperative evaluation, patients  $\leq 60$  years obtained significantly higher scores ( $U = 19.5$ ;  $p = 0.025$ ), while no difference was found between the two groups after surgery ( $U = 47.5$ ; NS).

### Psychological assessment

Table 4 shows the results obtained from male and female patients on BDI, STAI-X1, and STAI-X2. Though the difference was not significant, the depression score (BDI) was found to decrease between the preoperative and the postoperative evaluation in both groups, but particularly the women. Also, data relative to STAI-X1-X2 showed a small (but not significant) improvement after surgery both in male and female patients. Again, no significant change was found when the male patients were subdivided according to disease duration ( $\leq$  and  $>15$  years) and age ( $\leq 60$  and  $>60$  years) (table 5).

### Correlations

We also evaluated possible relations between sexual functioning (the SFI total score), the presence of depression and anxiety, the severity of the disease (H-Y scale), and dopaminergic treatment (LEDD). Correlations were assessed between modifications in the postoperative evaluation (preoperative minus postoperative scores). No significant correlation was found between changes in sexual functioning and the other variables.

### DISCUSSION

The most important finding of this study was the significant benefit, even if small, on sexual functioning after STN DBS

**Table 4** Beck depression inventory (BDI) and state-trait anxiety inventory (STAI) X1 and X2 total scores before and after surgery

	Men (n=21)		Women (n=10)	
	Before surgery	After surgery	Before surgery	After surgery
BDI	13.1 (9.0)	10.8 (5.8)	17.2 (9.2)	11.5 (7.0)
STAI-X 1	45.8 (10.3)	43.5 (10.5)	46.4 (6.6)	44.9 (10.8)
STAI-X2	46.5 (9.5)	45.1 (10.3)	48.4 (9.5)	45.4 (11.7)

Values are mean (SD).

BDI, Beck depression inventory; STAI, state-trait anxiety inventory.

**Table 5** Beck depression inventory (BDI) and state-trait anxiety inventory (STAI) X1 and X2 total scores in male patients subdivided according to age at the time of the surgical procedure

	Men aged ≤60 years (n=7)		Men aged >60 years (n=14)	
	Before surgery	After surgery	Before surgery	After surgery
BDI	14.0 (7.5)	12.4 (6.9)	12.6 (9.9)	10.0 (5.3)
STAI-X 1	48.4 (13.2)	46.4 (13.7)	44.5 (8.9)	42.0 (8.7)
STAI-X2	47.4 (7.9)	47.7 (12.3)	46.0 (10.5)	43.7 (9.3)

Values are mean (SD).

BDI, Beck depression inventory; STAI, state-trait anxiety inventory.

that was obtained by male patients with Parkinson's disease under 60 years of age—indeed, improvement in sexual satisfaction was more evident when only patients under 60 were considered. These patients obtained positive changes on the SFI total score and on the infrequency subscale. A general, even if small, improvement in their sexual life occurred and they showed a increased frequency of sexual intercourse with respect to the preoperative period. Dissatisfaction and avoidance subscales showed a trend to positive changes: the sexual relation became slightly more satisfactory and there was less avoidant behaviour by the patients towards their partners. In comparison with the male patients over 60, younger patients showed more sexual dissatisfaction before surgery. It is possible that the older patients were more ready to accept sexual difficulties, whether or not they were associated with the disease. Previous studies have reported that problems with sexual function increase with aging,<sup>22–23, 26</sup> but—as noted by Brown *et al*<sup>16</sup>—the presence of a sexual problem is not invariably associated with sexual dissatisfaction.

Our study is the first to evaluate sexual well being systematically in patients with Parkinson's disease after STN DBS, so directly comparable data are unavailable. Nevertheless it is possible to propose a hypothesis on the basis of published reports about sexual well being in Parkinson's disease.

No correlation between follow up modifications in H-Y, LEDD, and SFI total scores was found. The decrease in LEDD was not associated with a significant improvement in sexual functioning. This finding seems to confirm the data obtained by Lipe *et al*<sup>22</sup> and Brown *et al*<sup>18</sup>—that is, that dopaminergic treatment does not seem to be the most important determinant of sexual functioning. Moreover, the lack of correlation between improvement on H-Y stage after surgery and change in the total SFI score showed that the severity of disease was not a discriminating factor in sexual satisfaction. Published data are controversial on this point: one study found a negative correlation between H-Y and sexual satisfaction,<sup>21</sup> while others found no correlation or only a partial one.<sup>23–26</sup> Depression was found to correlate with sexual dissatisfaction in many studies.<sup>16, 22–25</sup> Again, we found no correlation between changes in depression or anxiety and in sexual satisfaction after surgery.

We did not identify any significant change in sexual satisfaction in female patients after surgery. A study investigating sexual esteem, satisfaction, and behaviour among people with physical disability found that women placed more emphasis on interpersonal aspects of sexual well being (tenderness and emotional sharing), while men focused more on their genital function.<sup>33</sup> Patients submitted to DBS STN obtain the most benefit in motor disability, an aspect particularly linked to sexual functioning in male patients.

Psychological evaluation identified a tendency for depression scores to improve, particularly in the female patients.

This suggests that depression and sexual satisfaction could once again be considered as separate domains. Indeed, a greater improvement in sexual satisfaction was obtained in the male group, who showed a smaller improvement on the depression score.

So far as the changes in sexual functioning are concerned, we cannot exclude the possibility that the reduction in the GRISS from its original format could have generated a loss of sensitivity to change in our SFI. The factors that made our patients reticent to complete all of the original scale could also have influenced our results. This was most likely to be true for the female group—clinical interviews with our female patients showed that they were most likely to play a passive role in the sexual relationship, which may partially explain the absence of changes.

As no cognitive side effects occurred in our patients, we can exclude disinhibition, a potentially relevant factor, as an explanation for our findings.<sup>6</sup> Nevertheless, our data do not allow us to advance any explanations for the possible causes of the slight improvement in sexual life that occurred. Even though no correlation was found between motor improvement and sexual change, we cannot exclude the possibility that the first may have an indirect effect on the second. Changes in the marital relationship could also be involved.

## Conclusions

Our study showed a small but significant improvement in sexual functioning in male patients with Parkinson's disease after DBS surgery, particularly in those under 60 years of age. No difference in sexual satisfaction was found in the women. Further studies assessing sexual function in the spouses of patients with STN DBS could improve our understanding of the changes that occur in the marital relationship after surgery.

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## Authors' affiliations

**L Castelli**, Department of Psychology, Centre for Cognitive Science, Turin, Italy

**P Perozzo, M L Genesia, E Torre, M Pesare, A Cinquepalmi, B Bergamasco, L Lopiano**, Department of Neuroscience, Turin, Italy  
**M Lanotte**, Division of Neurosurgery, CTO Hospital, Turin, Italy

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## APPENDIX 1

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Items and subscales composing the sexual functioning inventory (SFI), a reduced version of the GRISS (the Gollombok Rust inventory of sexual satisfaction). The first items are common to both the male and female versions

Do you feel uninterested in sex?

#### Infrequency

Are there weeks in which you don't have sex at all?

Do you have sexual intercourse more than twice a week?

#### Non-communication

Do you find it hard to tell your partner what you like or dislike about your sexual relationship?

Do you ask your partner what she/he likes and dislikes about your sexual relationship?

#### Male

##### Male dissatisfaction

Do you feel there is a lack of love and affection in your sexual relationship with your partner?

Are you dissatisfied with the amount of variety in your sex life with your partner?

Do you find your sexual relationship with your partner satisfactory?

##### Male avoidance

Do you try to avoid having sex with your partner?

Do you become tense and anxious when your partner wants to have sex?

Do you have feelings of disgust about what you and your partner do during lovemaking?

##### Male non-sensuality

Do you dislike being cuddled and caressed by your partner?

Do you enjoy cuddling and caressing your partner's body?

##### Premature ejaculation

Are you able to delay ejaculation during intercourse if you think you may be coming too quickly?

##### Impotence

Do you fail to get an erection?

#### Female

##### Female dissatisfaction

Do you feel there is a lack of love and affection in your sexual relationship with your partner?

Do you feel dissatisfied with the amount of time your partner spends on intercourse itself?

Do you find your sexual relationship with your partner satisfactory?

##### Female avoidance

Do you try to avoid having sex with your partner?

Do you become tense and anxious when your partner wants to have sex?

Do you have feelings of disgust about what you do during lovemaking?

##### Female non-sensuality

Do you dislike being cuddled and caressed by your partner?

Do you enjoy cuddling and caressing your partner's body?

##### Vaginismus

Is it possible for your partner's penis to enter your vagina without discomfort?

##### Anorgasmia

Do you find it impossible to have an orgasm?

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