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A Prospective Study on Sexual Function and Mood in Female-to-Male Transsexuals During Testosterone Administration and After Sex Reassignment Surgery

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Testosterone administration in female-to-male transsexual subjects aims to develop and maintain the characteristics of the desired sex. Very little data exists on its effects on sexuality of female-to-male transsexuals. The aim of this study was to evaluate sexual function and mood of female-to-male transsexuals from their first visit, throughout testosterone administration and after sex reassignment surgery. Participants were 50 female-to-male transsexual subjects who completed questionnaires assessing sexual parameters and mood. The authors measured reproductive hormones and hematological parameters. The results suggest a positive effect of testosterone treatment on sexual function and mood in female-to-male transsexual subjects.

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INTRODUCTION

Gender identity disorder is a condition in which physiologically normal people feel that they belong to the sex opposite to their biological one. This identification with the opposite sex and discomfort with the anatomical characteristics of the biological sex has an effective solution in cross-sex hormone therapy and thereafter in sexual reassignment surgery (Standards of Care for the Health of Transsexual, Transgender, and Gender Nonconforming People, 2011). Hormone therapy reduces three phenotypic characteristics of the original sex by facilitating facial and body hair growth, clitoridomegaly, and cessation of menses. Recently updated clinical practice guidelines have provided a standard of care for hormonal treatment and also eligibility criteria for surgery for these subjects (Godano et al., 2009; Gooren, 2011; Hembree et al., 2009; Meriggiola, Jannini, Lenzi, Maggi, & Manieri, 2010). Cross-sex hormone treatment is continued after sexual reassignment surgery and for the entire lifetime of the subject in order to maintain the developed physical characteristics and sexual steroid dependent physiological functions (Berra et al., 2006; Meriggiola et al., 2008). According to these guidelines the standard treatment for female-to-male (FTM) transsexuals consists of testosterone administration.

A large number of studies conducted in women and hypogonadal men indicate that testosterone plays an important role on sexual function and mood by improving sexual activity, interest, and desire (Andrade, Clapauch, & Buksman, 2009; Bancroft, 2005; Davis, Guay, Shifren, & Mazer, 2004; Saad et al., 2007). In contrast, little data have been published on transsexuals for various reasons, including the fact that there are no appropriate and validated questionnaires to assess sexual function in these subjects, follow-up is difficult, and there is only a small number of subjects followed in each center.

METHOD

Participants

We collected data from 50 FTM transsexual subjects. Inclusion criteria for all subjects was diagnosis of gender identity disorder according to the Diagnostic and statistical manual of mental disorders (American Psychiatric Association, 2000). Exclusion criteria were presence of psychiatric comorbidities diagnosed by mental health specialists, major chronic illness, any use of illicit drugs, and refusal to complete the questionnaires. All subjects were inexperienced of hormones at baseline.

All subjects received testosterone under various preparations and routes of administration, such as intramuscular injections of testosterone enanthate (Testoviron Depot, Schering AG, Berlin, Germany) 100 mg every 10–15 days, oral testosterone undecanoate (Andriol, Organon International, Oss, The

Netherlands), 40 mg/day twice daily, testosterone gel, 50 mg/day (Testogel, Bayer, Leverkusen, Germany) and intramuscular testosterone undecanoate (Nebid, Bayer Pharma AG, Berlin, Germany), 1000 mg administered at time 0, after 6 weeks and thereafter every 12 or 16 weeks.

This is a longitudinal prospective study, and data were collected for each subject before starting hormone treatment, after 12 months of hormone treatment, and at least 6 months after undergoing surgery. Surgery consisted of hysterioannexiectomy and reductive mammoplasty. At the time of the last interview, none of the subjects had undergone phalloplasty or any other reconstructive genital surgery.

Questionnaires

We collected data during a semi-structured interview that included questions referring to sociodemographics, education, physical health, medical history, smoking habits, sexual orientation, current and past relationships, and reproductive history. For stable relationship any kind of relation that included the same partner was intended. This interview was developed by researchers and included questions taken from different sources: questionnaires widely used in prior research on hormonal male contraception (Bagatell, Heiman, Matsumoto, Rivier, & Bremner, 1994; McNair, Lorr, & Dropplemain, 1971; Meriggiola et al., 2006) and those used to assess sexual function in clinical and nonclinical investigations (Clayton, Mcgarvey, & Clavet, 1997; Derogatis, 1997; Rosen, 1998). All subjects were asked by the same investigators to complete the same set of questionnaires the first of which consisted of eight questions on sexual parameters and function. The first six questions related to frequency of sexual intercourse, kissing, masturbation, desire, sexual fantasies, and arousal and were scored using a 9-point scale ranging from 0 (*never*) to 8 (*more than once a day*). The following two questions related to orgasm through masturbation and sexual intercourse. Scoring for these two questions on a 5-point scale ranging from 0 (*I've never tried*) to 5 (*more than 90%*). For sexual intercourse, any kind of sexual interaction with a partner was intended, including being masturbated by the partner. Subjects were not asked further details about sexual intercourse itself but its frequency. Masturbation included only self-masturbation. Two further questions were posed regarding satisfaction and happiness with an ongoing relationship. Question 1 was scored on a 6-point scale ranging from 0 (*extremely unsatisfied*) to 5 (*extremely satisfied*). Question 2 was scored on a 5-point scale ranging from 1 (*extremely unhappy*) to 5 (*extremely happy*). There were also 24 questions assessing mood, well-being, and aggressive behavior with scores reported on a 6-point scale ranging from 0 (*no*) to 5 (*absolutely yes*). The items explored were physiological measurements such as insomnia, snoring, sweating, energy, ability to relax, and feelings such as cheerfulness, lethargy, tension,

unhappiness, depression, irritability, readiness to fight, easily angered, and anger/aggressiveness. Questionnaires were self-administered. Subjects were asked to take the previous month as the point of reference.

The questionnaire was tested in a two-phase pilot study: the questions were partially rephrased and adapted for the transsexual subjects. In a second phase, in-depth, qualitative interviews were set up with 10 subjects: 5 at baseline and 5 subjects who had already undergone surgery. Comments obtained from both phases were integrated in the final version of the questionnaire. The ethical committee of the hospital approved the present study and all subjects signed a written consent form.

Hormone Measurements

All blood samples were drawn in the morning between 8:00 a.m. and 10:00 a.m. Plasma samples were centrifuged at 3000 g for 15 min and then separated and immediately stored at -20°C . Serum testosterone, estrogen, luteinizing hormone, and follicle-stimulating hormone levels were measured using a commercial elettrochemiluminescence immunoassay (Cobas e Immunoassay Analyzer, Roche Diagnostics, Basel, Switzerland), detection limits were 0.025 ng/mL, 5.00 pg/mL, 0.100 mIU/mL, and 0.100 mIU/mL for testosterone, estrogen, luteinizing hormone, and follicle-stimulating, respectively. Mean interassay coefficients of variation were below 5% for testosterone and estrogen, below 2% for luteinizing hormone and follicle-stimulating hormone. Concentrations of sex hormone-binding globulin were determined by chemiluminescent immunometric assay (Immulite 2000, Siemens Diagnostics, Tarrytown, New York). Detection limit was 0.02 nmol/L, mean intraassay coefficient of variation was below 5%. Levels of free testosterone were calculated from levels of sex hormone-binding globulin and total serum testosterone according to a previously published and generally accepted calculation method (Vermeulen, Verdonck, & Kaufman, 1999).

Statistical Analysis

Age was expressed in terms of mean \pm standard deviation of the mean. The Kolmogorov-Smirnov test showed that, in general, continuous parameters were not normal, after which nonparametric tests were adopted and the continuous parameters were expressed in terms of median and 25th and 75th percentiles. Grouping variables were expressed as frequency and percentage rates.

The Wilcoxon test with Sidak correction for multiple comparisons was performed to assess score differences at different follow-up times. We used the Mann-Whitney test to assess the influence of presence-absence of a relation on the scores; we used the Kruskal-Wallis test to assess the influence of education on the scores. A nonparametric least significant difference test

was used as post hoc pair wise comparison of the Kruskal-Wallis test. Spearman rank correlation was performed to assess the relation between age and scores. We used the generalized linear model repeated measures to assess the influence of hormones and hematological parameters on sexual parameters at different times. For all tests, $p < .05$ was considered significant. Statistical analysis was carried out using SPSS (version 15).

RESULTS

Study Population

Recruitment for this study started in 2001. The final subject was enrolled in 2008. During the 8 years, we screened 78 subjects and among those screened between 2001 and 2008, 7 refused to fill in the questionnaire, 7 were excluded from this study because of use of antidepressant drugs or other psychiatric comorbidities, 6 because they had already started hormone treatment, and 8 were lost at follow-up. One subject who was included decided to stop hormone treatment and not to transit. This subject was replaced with a new subject in order to achieve the total number of 50 subjects.

Table 1 shows the characteristics of the subjects included in the study at baseline. Twenty subjects started treatment with testosterone enanthate, 11

TABLE 1. Demographic Characteristics of Study Population ($N = 50$)

Characteristic	% (n)
Age at baseline (years)	29.8 \pm 6.1
Age at postsurgery follow-up (years)	34.8 \pm 6.3
Active smoking (baseline)	
Baseline	46% (23)
Month 12 after treatment	32% (16)
Postsurgery follow-up	30% (15)
Education at baseline	
Secondary school	20% (10)
High school	70% (35)
Degree	10% (5)
Occupational status	
Unemployed	14% (7)
Employed	70% (35)
Student	16% (8)
Sexual orientation at baseline	
Bisexual	2% (1)
Heterosexual	98% (49)
Homosexual	0
In a stable relationship at baseline	46% (23)
In a stable relationship at month 12	40% (20)
In a stable relationship after surgery	44% (22)
Children born at baseline	4% (2)
Children born after surgery	2% (1)

subjects with oral testosterone undecanoate, 11 with testosterone gel, and 8 with intramuscular testosterone undecanoate. After 12 months of treatment, 28 subjects were using testosterone enanthate, 2 subjects were using oral testosterone undecanoate, 12 were using testosterone gel, and 8 were using intramuscular testosterone undecanoate. After surgery, 18 subjects continued to use testosterone enanthate, no subject was using oral testosterone undecanoate, 6 were using testosterone gel, and 26 were using intramuscular testosterone undecanoate.

The age range of the subjects studied was 18 to 45 years. Two subjects were in a stable relationship and had delivered babies before hormone therapy started. One subject's wife had had twins using gamete donation with assisted reproduction techniques after the partner's surgery. At baseline, 23 subjects were involved in a stable relationship, 20 subjects at month 12 of testosterone administration, and 22 subjects after surgery. All subjects who were involved in a relationship were in a heterosexual relationship (relationship with a female), 1 was bisexual at baseline and remained bisexual throughout the entire duration of the study, but was not in a stable relationship. The third interview was carried out 32 ± 5.2 ($M \pm SD$) months after surgery (range = 6–96 months).

Sexual Parameters

All parameters of sexual function evaluated in this study tended to increase after hormone administration. Frequency of desire, masturbation, sexual fantasies, and arousal significantly increased after one year of testosterone administration. Frequency of kissing, sexual fantasies, and arousal returned to baseline after surgery.

At month 12 of testosterone administration, frequency of desire increased in 16 subjects and decreased in 2. Frequency of masturbation increased in 14 subjects and decreased in 2. Frequency of sexual fantasies increased in 18 subjects and decreased in 4. Frequency of arousal increased in 19 subjects and decreased in 2.

After surgery, frequency of desire increased in 6 subjects and decreased in 11. Frequency of masturbation increased in 5 subjects and decreased in 12. Frequency of sexual fantasies increased in 1 subject and decreased in 9. Frequency of arousal increased in 1 subject and decreased in 13.

There was no difference in these parameters between the group with a stable partner and the group without a stable partner or those not in a stable relationship. This may be due to the small size of the groups that were not involved in a stable relationship during the whole study period, as mentioned earlier.

No differences were found at any time point for any sexual parameters between subjects who were in a stable relationship and those who were not.

TABLE 2. Median (25th–75th Percentile) of Subjects' Sexual Parameters Before and During Treatment With Testosterone and After Sex Reassignment Surgery

	Baseline	Month 12 of treatment	Postsurgery follow-up	Significance	
				*	§
Frequency of sexual intercourse ^a	4.0 (0.8–5.0)	4.0 (1.0–5.0)	4.0 (1.0–6.0)	<i>ns</i>	<i>ns</i>
Frequency of kissing ^a	6.5 (1.0–8.0)	6.0 (3.3–8.0)	6.0 (1.5–8.0)§	<i>ns</i>	.026
Frequency of masturbation ^a	3.0 (0.5–5.0)	5.0 (1.0–7.0)*	4.0 (1.3–5.8)	.0001	<i>ns</i>
Orgasm with masturbation ^b	4.0 (2.0–5.0)	5.0 (2.3–5.0)	5.0 (4.0–5.0)	<i>ns</i>	<i>ns</i>
Orgasm with sexual intercourse ^b	3.0 (0.8–5.0)	3.5 (1.3–5.0)	5.0 (3.0–5.0)	<i>ns</i>	<i>ns</i>
Frequency of desire ^a	5.0 (3.0–6.0)	6.0 (6.0–8.0)*	6.0 (4.0–7.0)	.0014	<i>ns</i>
Frequency of sexual fantasies ^a	6.0 (3.0–6.3)	7.0 (6.0–8.0)*	6.0 (4.0–7.0)§	<.0005	.037
Frequency of arousal ^a	5.5 (3.0–7.0)	7.0 (5.3–7.0)*	5.5 (4.0–7.0)§	<.0005	.007
Satisfaction with relationship	3.0 (3.0–5.0)	4.0 (3.0–5.0)	4.0 (3.0–5.0)	<i>ns</i>	<i>ns</i>
Happiness with relationship	2.0 (1.0–3.0)	2.0 (2.0–3.0)	3.0 (2.0–3.72)	<i>ns</i>	<i>ns</i>

^aScores ranged from 0 (*not at all*) to 8 (*more than once a day*).

^bScores ranged from 0 (*I've never tried*) to 5 (*more than 90%*).

* $p \leq .05$ versus baseline (Sidak correction).

§ $p \leq .05$ versus month 12 of treatment (Sidak correction).

No differences were reported in satisfaction and happiness with relationship during all phases of the study among the subjects that were in a relationship (stable or not). No differences were reported in any of these sexual parameters when compared with the months after surgery considering that time to surgery was ≤ 1 year for 19 out of 50 subjects and ≥ 1 year for 31 out of 50 subjects.

Mood and Behavior

Measures of mood and well-being did not change throughout the study. Insomnia and sweating significantly increased after treatment compared with baseline ($p = .01$) and insomnia remained significantly higher after surgery compared with baseline ($p = .008$). Snoring was significantly higher after treatment compared with baseline ($p = .03$) and remained significantly higher after surgery in comparison with baseline ($p = .01$). We found a statistically significant decrease of “ready to fight” and “easily angered” after surgery compared with the posttreatment phase.

TABLE 3. Median (25th–75th Percentile) of Subjects' Mood Before and During Treatment With Testosterone and After Sex Reassignment Surgery

	Baseline	Month 12 of treatment	Postsurgery follow-up	Significance	
				*	§
Cheerful	1.0 (0.8–2.0)	1.0 (1.0–2.0)	2.0 (1.0–2.0)	<i>ns</i>	<i>ns</i>
Lethargic	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	<i>ns</i>	<i>ns</i>
Relaxed	1.0 (0.0–1.0)	1.0 (0.0–2.0)	1.0 (0.0–2.0)	<i>ns</i>	<i>ns</i>
Tense	1.0 (0.0–2.0)	1.0 (0.0–1.0)	1.0 (0.0–1.0)	<i>ns</i>	<i>ns</i>
Energetic	1.5 (1.0–2.0)	2.0 (1.0–3.0)	1.0 (1.0–2.0)	<i>ns</i>	<i>ns</i>
Unhappy	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	<i>ns</i>	<i>ns</i>
Depression	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	<i>ns</i>	<i>ns</i>
Insomnia	0.0 (0.0–1.0)	0.0 (0.0–2.0)*	0.0 (0.0–1.0)*	.01 .008	<i>ns</i>
Sweating	1.0 (0.0–1.0)	1.0 (0.0–2.0)*	1.0 (0.0–2.8)	.01	<i>ns</i>
Snoring	0.0 (0.0–0.0)	0.0 (0.0–1.0)*	0.0 (0.0–1.0)*	.03 .01	<i>ns</i>
Irritable	1.0 (0.0–2.0)	1.0 (0.0–1.0)	1.0 (0.0–1.0)	<i>ns</i>	<i>ns</i>
Ready to fight	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)§	<i>ns</i>	.004
Easily angered	1.0 (0.0–2.0)	1.0 (0.0–1.0)	0.0 (0.0–1.0)§	<i>ns</i>	.004
Anger/aggressiveness	1.0 (0.0–2.0)	1.0 (0.0–2.0)	1.0 (0.0–2.0)	<i>ns</i>	<i>ns</i>

Note. Scores ranged from 0 (*not at all*) to 4 (*extremely*).

* $p \leq .05$ versus baseline (Sidak correction).

§ $p \leq .05$ versus posttreatment follow-up (Sidak correction).

Hormone Parameters

Hormone levels at the time of interviews are reported in Table 4. Hormone levels including testosterone levels reported in this table represent serum levels at different times post testosterone intake. Testosterone levels increased after testosterone administration and remained increased after surgery.

Correlation between luteinizing hormone, follicle-stimulating hormone, sex hormone-binding globulin, estrogen, total testosterone and free testosterone and various parameters of sexual function and mood did not report any statistical significance, apart from the frequency of sexual intercourse, which was positively correlated with testosterone values by generalized linear model repeated measures analysis ($p = .039$ $\eta^2 = 0.054$). No differences were found between sexual parameters and the different formulations of testosterone that were used during the study period.

DISCUSSION

In this study, we evaluated the sexual function, mood and well-being of 50 FTM transsexuals at their initial visit to the clinic, after 12 months of cross-sex hormonal therapy with testosterone and after sex reassignment surgery. To the best of our knowledge, this is the first study to evaluate sexual function and mood in a longitudinal prospective manner throughout the transition,

TABLE 4. Median (25th–75th Percentile) of Hormonal Values Before and During Treatment With Testosterone and After Sex Reassignment Surgery

	Baseline	Month 12 of treatment	Postsurgery follow-up	Significance	
				*	§
Testosterone (ng/mL)	0.4 (0.4–0.5)	5.8 (3.8–7.1)*	5.1 (3.5–7.1)*	<.0005	.0001
Free testosterone (nmol/L)	0.01 (0.01–0.01)	0.21 (0.15–0.30)*	0.26 (0.19–0.33)	<.0005	<i>ns</i>
SHBG (nmol/L)	63.0 (56.0–83.0)	29.5 (27.0–36.0)*	23.0 (22.0–27.5)*	.0002	<i>ns</i>
LH (mIU/mL)	6.7 (4.1–14.0)	5.2 (3.2–7.7)	23.5 (6.2–38.4)*§	.006	.0025
FSH (mIU/mL)	5.1 (3.9–6.5)	5.6 (3.9–6.8)	38.6 (17.9–55.2)*§	.001	.0019
Estrogen (pg/mL)	115.0 (48.8–187.8)	60.0 (42.8–83.8)*	28.0 (16.0–34.0)*§	.01	.0008
Hemoglobin (g/dL)	13.3 (12.4–13.9)	15.0 (13.9–15.7)*	15.2 (14.5–15.8)*§	<.0005	.0004
Hematocrit (%)	39.9 (37.9–40.8)	44.2 (40.9–46.7)*	44.5 (43.1–46.5)*	.0001	.0002

* $p \leq .05$ versus baseline (Sidak corrections).

§ $p \leq .05$ versus posttreatment follow-up (Sidak corrections).

in transsexual FTM subjects. After 1 year of testosterone administration subjects experienced an improvement in general sexual function compared with baseline. In particular, frequency of masturbation, sexual desire, arousal, and sexual fantasies were the most affected parameters. In the postsurgery questionnaires, sexual parameters returned to baseline in most of the subjects, remaining increased only in about 25%. Total testosterone levels were positively associated only with frequency of sexual intercourse. Most of the mood parameters evaluated did not show significant changes throughout the study periods; however, insomnia, sweating, and snoring increased after testosterone administration and remained higher after surgery and “ready to fight” and “easily angered” decreased after surgery when compared with the posttreatment phase.

We found a small but significant increase in frequency of masturbation, sexual desire, arousal and sexual fantasies after testosterone administration, which agrees with previous cross-sectional data in FTM subjects, in hypogonadal men and in women and confirms that testosterone is positively correlated with these aspects of sexual function (Andrade et al., 2009; Bachmann, 2002; Saad et al., 2007). Other aspects such as satisfaction with changes in phenotypic characteristics may have had a positive influence on sexual function in this phase of transition in these subjects. However, compared with previous reports, a relatively small number of subjects in our sample showed an increase in sexual desire and an even lower number maintained this increase after surgery. In our study, we explored only the frequency of this aspect of sexual function. A more complete and thorough investigation on intensity of desire, discerning solitary from dyadic desire may have provided different results. Another contributory aspect may be the testosterone regimen used. We treated FTM subjects with relatively low testosterone doses (100 mg every 7–10 days) trying to avoid the large supraphysiological testosterone peaks that occur when higher doses such as 250 mg of testosterone esters are used. These lower testosterone peaks may be responsible for the reduced effects on some aspects of sexual function such as sexual desire.

All subjects included in this study underwent surgery, which consisted of hysterectomy, ovariectomy, and reductive mammoplasty (Perrone et al., 2010; Wierckx et al., 2011). None of the subjects included in this study had metoidoplasty or phalloplasty performed at the time of the third interview. This may explain why the third and last interview, which was carried out after surgery, showed that the frequency of some parameters such as kissing, arousal, and sexual fantasies returned to baseline levels. In the last interview, only about 25% of the subjects showed an increase in frequency of some of the sexual parameters. In Italy, phalloplasty or metoidoplasty is not routinely and consistently performed in any center and sometimes subjects are forced to go abroad to have this surgery done. Costs and organizational problems inhibit most FTM subjects from taking this route. Incomplete sex reassignment surgery, which did not include phalloplasty or metoidoplasty, may

have generated dissatisfaction and failed expectations, which may have contributed to the decrease of some aspects of sexual function in the interview performed after surgery. These results are different from most observations reported in literature in which many subjects expressed satisfaction with their sexual life in terms of frequency and quality of intercourse, increase in masturbation and arousal and an increased ability to reach orgasm (Cohen-Kettenis & van Goozen, 1997; De Cuypere et al., 2005; De Cuypere et al., 2006; Klein & Gorzalska, 2009; Murad et al., 2010; Wierckx et al., 2011). To compare these results with those reported in literature is not easy not only because, as we have already pointed out, no longitudinal studies on FTM exist but also because many studies have been conducted on small groups of patients. Most of the previous reports do not differentiate FTM from MTF, and some studies only focused on one topic of sexual health, mainly orgasm (Lief & Hubschman, 1993). It should also be considered that self-reporting of sexual function and sexuality may underreport or overreport the truth (Klein & Gorzalska, 2009). Another possibility is that subjects may have become accustomed to the higher testosterone levels.

We also found a significant positive relation between frequency of sexual intercourse and levels of total testosterone with no association to particular times of administration of the questionnaires. No other association between testosterone or luteinizing hormone and parameters of sexual function such as desire were detected. In a previous study, no direct association between levels of testosterone and sexual desire were detected but measures of sexual desire were inversely associated with luteinizing hormone levels (Wierckx et al., 2011). However, in our study, blood samples for the measurement of testosterone and luteinizing hormone levels were taken randomly after testosterone intake and therefore may not represent the real testosterone milieu to which these subjects were exposed.

Another finding of our study is that sweating, insomnia, and snoring, which were statistically significantly increased after cross-sex hormonal therapy and remained so after surgery when compared with baseline. In particular nocturnal and general sweating might be related to testosterone administration as demonstrated in previous studies on male hormonal contraception (Kamischke et al., 2002; Mommers et al., 2008). It may be that maintaining lower serum testosterone levels after surgery could decrease these effects and avoid any other side effects due to supraphysiological doses of testosterone, thereby improving the wellbeing of these people.

We found a statistically significant decrease in anger/aggressiveness, ready to fight, and easily angered after surgery compared with baseline. Although these changes are small, in contrast with our comments on sexual function, they may suggest a trend toward satisfaction with some aspects of surgery that may have positively influenced the mood of some of these subjects. The surgery, although incomplete because it did not include reconstruction of the phallus, represents an important achievement in the medical

path for the relief of gender dysphoria in these people (Wierckx et al., 2011). Despite that the health care system in Italy provides full medical coverage to the people who want to transit, this process is, in many cases, still difficult because it is often full of discrimination and marginalization (Bandini et al., 2011; Fisher et al., 2010). The reassignment and the beginning of a new life in the desired sex may have obvious positive effects on mood.

This study has some important limitations that should be underlined. First, the lack of a placebo control group; it was not possible to include this for obvious ethical reasons. Important limitations are also related to the questionnaires, being the lack of standardized questionnaires able to assess sexual satisfaction for this population. The use of validated instruments with appropriate language, questions, and scales would help to record more detailed results and to highlight more subtle changes in other aspects of sexual function. Our questionnaires also did not measure the intensity of each parameter but only its frequency. This may be a limitation because the quality of sexual life may be more important than its quantity/frequency. Last, another limitation may be the bias in self-perception that may exist. It is important to consider how complicated self evaluation of the emotional state may be. The lack of more extensive and consistent hormone measurements, as already commented earlier, also greatly limits our ability to comprehend the association between testosterone treatment and changes in sexual function.

The aforementioned limitations of this study require further investigations both to confirm our results and to improve our knowledge. However, given that this is the first longitudinal prospective study to report on sexual function in FTM subjects, we believe that this is important and useful information and that it represents a starting point for more large-scale and detailed prospective studies.

In conclusion, this is the first study to evaluate in a longitudinal prospective manner the effects of testosterone administration on some aspects of sexual function and mood of FTM transsexual subjects. Our longitudinal data confirms previous cross-sectional data of an overall positive effect on many parameters of sexual function and aspects of mood such as anger/aggressiveness of testosterone treatment in FTM subjects throughout the transition periods. In our longitudinal evaluation, frequency of kissing, sexual fantasies, and arousal returned to baseline in the postsurgery period. Sweating, insomnia, and snoring increased after testosterone treatment and remained increased in the postsurgery evaluation. It may be that adjustments in testosterone dosage in some FTM subjects could reduce these side effects.

REFERENCES

- Aloisi, A. M., Bachiocco, V., Costantino, A., Stefani, R., Ceccarelli, I., Bertaccini, A., & Meriggiola, M. C. (2007). Cross-sex hormone administration changes pain in transsexual women and men. *Pain*, 132(Suppl. 1), S60–S67.

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington DC: Author.
- Andrade, E. S. J., Clapauch, R., & Buksman, S. (2009). Short term testosterone replacement therapy improves libido and body composition. *Arquivos Brasileiros de Endocrinologia e Metabologia*, 53, 996–1004.
- Bachmann, G. A. (2002). The hypoandrogenic woman: Pathophysiologic overview. *Fertility and Sterility*, 77(Suppl. 4), S72–S76.
- Bagatell, C. J., Heiman, J. R., Matsumoto, A. M., Rivier, J. E., & Bremner, W. J. (1994). Metabolic and behavioural effects of high-dose, exogenous testosterone in healthy men. *Journal of Clinical Endocrinology and Metabolism*, 79, 561–567.
- Bancroft, J. (2005). The endocrinology of sexual arousal. *Journal of Endocrinology*, 186, 411–427.
- Bandini, E., Fisher, A. D., Ricca, V., Ristori, J., Meriggiola, M. C., Jannini, E. A., . . . Maggi, M. (2011). Childhood maltreatment in subjects with male-to-female gender identity disorder. *International Journal of Impotence Research*, 23, 276–285.
- Berra, M., Armillotta, F., D'Emidio, L., Costantino, A., Martorana, G., Pelusi, G., & Meriggiola, M. C. (2006). Testosterone decreases adiponectin levels in female-to-male transsexuals. *Asian Journal of Andrology*, 8, 725–729.
- Clayton, A. H., Mcgarvey, E. L., & Clavet, G. L. (1997). The Changes in Sexual Functioning Questionnaire (CSFQ): Development, reliability and validity. *Psychopharmacology Bulletin*, 33, 731–745.
- Cohen-Kettenis, P. T., & van Goozen, S. H. M. (1997). Sex reassignment of adolescent transsexuals: A follow-up study. *Journal of the American Academy of Child & Adolescent Psychiatry*, 36, 263–271.
- Davis, S. R., Guay, A. T., Shifren, J. L., & Mazer, N. A. (2004). Endocrine aspects of female sexual dysfunction. *Journal of Sexual Medicine*, 1, 82–86.
- De Cuypere, G., Elaut, E., Heylens, G., Van Maele, G., Selvaggi, G., T'Sjoen, G., . . . Monstrey, S. (2006). Long-term follow-up: Psychosocial outcome of Belgian transsexuals after sex reassignment surgery. *Sexologies*, 15, 126–133.
- De Cuypere, G., T'Sjoen, G., Beerten, R., Selvaggi, G., De Sutter, P., Hoebeke, P., . . . Rubens, R. (2005). Sexual and physical health after sex reassignment surgery. *Archives of Sexual Behavior*, 34, 679–690.
- Derogatis, L. R. (1997). The Derogatis Interview for Sexual Functioning (DISF/DISF-SR): An introductory report. *Journal of Sex & Marital Therapy*, 23, 291–304.
- Fisher, A. D., Bandini, E., Ricca, V., Ferruccio, N., Corona, G., Meriggiola, M. C., . . . Maggi, M. (2010). Dimensional profiles of male to female gender identity disorder: An exploratory research. *Journal of Sexual Medicine*, 7, 2487–2498.
- Godano, A., Maggi, M., Jannini, E., Meriggiola, M. C., Ghigo, E., Todarello, O., . . . Manieri, C. (2009). SIAMS-ONIG consensus on hormonal treatment in gender identity disorders. *Journal of Endocrinological Investigation*, 32, 857–869.
- Gooren, L. J. (2011). Clinical practice: Care of transsexual persons. *New England Journal of Medicine*, 364, 1251–1257.
- Hembree, W. C., Cohen-Kettenis, P., Delemarre-Van de Waal, H. A., Gooren, L. J., Meyer, W. J. III, Spack, N. P., . . . Montori, V. M. (2009). Endocrine treatment of transsexual persons: An Endocrine Society Clinical Practice Guideline. *Journal of Clinical Endocrinology and Metabolism*, 94, 3132–3154.

- Kamischke, A., Heuermann, T., Krüger, K., von Eckardstein, S., Schellschmidt, I., Rübig, A., & Nieschlag, E. (2002). An effective hormonal male contraceptive using testosterone undecanoate with oral or injectable norethisterone preparations. *Journal of Clinical Endocrinology and Metabolism*, 87, 530–539.
- Klein, C., & Gorzalska, B. B. (2009). Sexual functioning in transsexuals following hormone therapy and genital surgery: A review. *Journal of Sexual Medicine*, 6, 2922–2939.
- Lief, H. I., & Hubschman, L. (1993). Orgasm in the postoperative transsexual. *Archives of Sexual Behavior*, 22, 145–155.
- McNair, D. M., Lorr, M., & Dropplemain, L. F. (1971). *Profile of mood states, POMS, educational and industrial testing service*. San Diego, CA: Educational and Industrial Testing Services.
- Meriggiola, M. C., Armillotta, F., Costantino, A., Altieri, P., Saad, F., Kalhorn, T. . . Pelusi, G. (2008). Effects of testosterone undecanoate administered alone or in combination with letrozole or dutasteride in female to male transsexuals. *Journal of Sexual Medicine*, 5, 2442–2453.
- Meriggiola, M. C., Cerpolini, S., Bremner, W. J., Mbizvo, M. T., Vogelsong, K. M., Martorana, G., & Pelusi, G. (2006). Acceptability of an injectable male contraceptive regimen of norethisterone enanthate and testosterone undecanoate for men. *Human Reproduction*, 21, 2033–2040.
- Meriggiola, M. C., Jannini, E. A., Lenzi, A., Maggi, M., & Manieri, C. (2010). Endocrine treatment of transsexual persons: An Endocrine Society Clinical Practice Guideline: Commentary from a European perspective. *European Journal of Endocrinology*, 162, 831–833.
- Mommers, E., Kersemaekers, W. M., Elliesen, J., Kepers, M., Apter, D., Behre, H. M., . . . Zitzmann, M. (2008). Male hormonal contraception: A double-blind placebo-controlled study. *Journal of Clinical Endocrinology and Metabolism*, 93, 2572–2580.
- Murad, M. H., Elamin, M. B., Zumaeta Garcia, M., Mullan, R. J., Murad, A., Erwin, P. J., & Montori, V. M. (2010). Hormonal therapy and sex reassignment: A systematic review and meta-analysis of quality of life and psychosocial outcomes. *Clinical Endocrinology*, 72, 214–231.
- Perrone, A. M., Scifo, M. C., Martelli, V., Casadio, P., Morselli, P. G., Pelusi, G., & Meriggiola, M. C. (2010). Hysterectomy and bilateral salpingoovariectomy in a transsexual subject without visible scarring. *Diagnostic and Therapeutic Endoscopy*, 1–4.
- Rosen, R. C. (1998). Sexual function assessment in the male: Physiological and self-report measures. *International Journal of Impotence Research*, 10, S59–S63.
- Saad, F., Kamischke, A., Yassin, A., Zitzmann, M., Schubert, M., Jockenhövel, F., . . . Nieschlag, E. (2007). More than eight years' hands-on experience with the novel long-acting parenteral testosterone undecanoate. *Asian Journal of Andrology*, 9, 291–297.
- Standards of Care for the Health of Transsexual, Transgender, and Gender Non-conforming People. (2011). *The World Professional Association for Transgender Health* (7th version). Retrieved from <http://www.wpath.org>

- Vermeulen, A., Verdonck, L., & Kaufman, J. M. (1999). A critical evaluation of simple methods for the estimation of free testosterone in serum. *Journal of Clinical Endocrinology and Metabolism*, 84, 3666–3672.
- Wierckx, K., Elaut, E., Van Caenegem, E., Van De Peer, F., Dedecker, D., Van Houdenhove, E., & T'Sjoen, G. (2011). Sexual desire in female-to-male transsexual persons: Exploration of the role of testosterone administration. *European Journal of Endocrinology*, 165, 331–337.
- Wierckx, K., Van Caenegem, E., Elaut, E., Dedecker, D., Van de Peer, F., Toye, K., . . . T'Sjoen, G. (2011). Quality of life and sexual health after sex reassignment surgery in transsexual men. *Journal of Sexual Medicine*, 8, 3379–3388.