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The Influence of Ejaculation and Abstinence on Urinary Flow Rates

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Aims: To investigate the relationship between urinary flow rate and ejaculation in healthy young men. **Methods:** Young men were voluntarily enrolled in the study. All subjects were healthy, and sexually active, without neurological diseases, genital, or urethral surgery and they were not under any medications. Subjects were evaluated with ultrasound, uroflowmetry, and post-void residual urine (PVR) measurement. All subjects were followed for 22 days (T) with daily uroflowmetry, and were instructed to ejaculate only on specific days (0, 6 and 22) during the study period. On days 0, 6 and 22 uroflow measurements were performed between 2 and 6 hr following ejaculation. Uroflowmetry parameters before and after ejaculation and during abstinence were compared. Data presented a non-normal distribution and the non-parametric Wilcoxon-match-paired test and Kruskal–Wallis test were used for statistical analysis. **Results:** 18 subjects (mean age 27.4years) completed the study. A total of 414 uroflow charts were collected. A statistical significant increase in Qmax was observed after ejaculation (T-1 Qmax: 22.7 ± 5.4 vs. T0 Qmax: 25.7± 8, $P^{Q2} = 0.002$; T5 Qmax 23.2 ± 5.4 vs. T6 Qmax 25.4 ± 8, $P = 0.031$; T21 Qmax 21 ± 4.8 vs. T22 Qmax 24.5 ± 7.9, $P = 0.031$). Sexual abstinence resulted in a progressive, statistically significant decline in Qmax rates (T0 Qmax 25.7 ± 8 vs. T5 23.2 ± 5.4 $P = 0.035$; T6 Qmax 25.4 ± 8 vs. T21 Qmax 21 ± 4.8, $P = 0.01$). PVR did not change during the study period. **Conclusions:** Our results suggest that in young healthy men micturition might be influenced by ejaculation. Our findings, if confirmed in larger series of patients with LUTS, should support that sexual status and activity could represent an important confounding factor in the interpretation of uroflowmetry traces. *Neurourol. Urodynam 9999:1–5, 2011.* © 2011 Wiley-Liss, Inc.

Key words: sexual abstinence; uroflowmetry; urinary flow; urodynamics; ejaculation; LUTS

INTRODUCTION

Uroflowmetry, the measurement of urine flow over time, is regarded as one of the most useful, simple, and widely used tests for the assessment of lower urinary tract symptoms (LUTS). Uroflowmetry may raise suspicion of obstruction of the lower urinary tract, which can be then subsequently investigated and confirmed by more invasive tests.[1] However, uroflowmetry per se, cannot provide accurate information necessary to distinguish between the true presence of bladder outlet obstruction or detrusor underactivity as both may result in a reduction in flow rates. Despite this lack of sensitivity its value as a first line non-invasive, diagnostic tool for the evaluation of LUTS is unquestionable.[2]

As several factors are known to affect the reliability of a single office uroflowmetry, the results of a single-flow measurement should be interpreted with caution,[3] although it has been reported that flow variation in an individual is relatively insignificant.[4–5] Notwithstanding the relationship between prostatic and urethral diseases and peak flow rate is well known, it is also influenced by patient age and voided volume.[6]

Furthermore, there have been several reports evaluating other possible confounding factors in the interpretation of uroflometry as the influence of the subject's position during micturition. The results have shown the maximum urinary flow rate to be highest in the prone position, followed by the standing, sitting, supine, and finally the lateral positions in normal males.[7] The authors have presented these results without speculating on the possible underlying physiologic reasons for these discrepancies.

Others researchers have investigated the variation of urinary flow rate in women only to show that there was no influence of the menstrual cycle phases on urinary flow rates. Nevertheless the possible role of menstrual cycle on uroflowmetry traces remains uncertain. Moreover, the same authors demonstrated a, more or less anticipated, negative effect of urethral catheterization on uroflowmetry, suggesting caution when analyzing uroflowmetry measurements obtained after urethral catheterization.[8] More recently, a variety of common and potentially confounding variables (stress, anxiety, caffeine intake, sexual activity) believed to impact on the results of uroflowmetry were evaluated. However, none of these factors demonstrated a significant influence on uroflowmetry parameters [9].

In 2003, Jacobsen evaluated the relationship between LUTSs and frequency of ejaculation, using cross-sectional data from the Olmsted County Study of Urinary Symptoms and Health Status Among Men. After adjusting for age, the odds ratio for ejaculation frequency and symptom severity was 0.99 (95% CI 0.79–1.24) and was similar for peak urinary flow rates and prostate volume. The authors based on these results definitively concluded that there was no relationship between

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sexual activity and the results of uroflowmetry.[10] However, until today, no trial has been designed in order to investigate the possible, if any, influence of ejaculation on urinary flow rates. The aim of this study is to evaluate the possible relationship between urinary flow rate and sexual function in a group of healthy young men.

MATERIAL AND METHODS

From January 2009 onwards, male medical students and urology residents between 20 and 35 years of age were voluntarily enrolled. All subjects were on stable heterosexual relationships, were healthy, were not under any medications known to interfere with lower urinary tract function, were sexually active without erectile dysfunction, according to the International Index of Erectile Function (IIEF) and without LUTSs (evaluated by the International Prostate Symptom Score, IPSS, and defined by an IPSS score <5). Subjects with a history of genital or urethral surgery, or neurological disease were excluded from the study. All subjects signed a dedicated informed consent and the study received an internal review board approval.

At baseline (T-1) (which was defined as a day in the week before enrolment) each volunteer was evaluated with an abdominal and suprapubic ultrasound scan using a Falcon ultrasonograph (B-K Medical, Milan, Italy) equipped with a curved array transducer (2.5–5 MHz; 8665 probe B-K Medical, Milan, Italy), an uroflowmetry (Urodyn 1000, Medtronic, Minneapolis MN), and an ultrasound PVR measurement.

Subjects were then followed for 22 consecutive days and were daily evaluated with uroflowmetry performed as an outpatient procedure in our prostate clinic. All flow rates were measured in the morning in all subjects and each subject entered the study (T0) on the same day of the week (Monday). PVR was evaluated and recorded by a specialist nurse with a suprapubic ultrasound scan at the end of each uroflowmetry. Regarding the proposed period of sexual abstinence, it was arbitrarily decided and the volunteers were instructed to have a single ejaculation (by masturbation or sexual intercourse) only on days 0 (T0), 6 (T6), and 22 (T22) during the study period. On those specific days (T0, T6, T22) uroflow studies were performed between 2 and 6 hr following ejaculation to allow each volunteer to reach the outpatient clinic within an acceptable, although arbitrary, time. The adherence of the subjects to the protocol was self-reported. However, we spent time with each volunteer enrolled in the study to stress the importance of adhering to the protocol and reporting any deviations from the protocol (sexual activity with or without ejaculation, nocturnal pollution). Patients were not investigated on how they reached ejaculation (sexual intercourse vs. masturbation).

The changes in uroflowmetry parameters (maximum urinary flow rate-Qmax), voiding volume and PVR before and after ejaculation and during the period of sexual abstinence were compared. All uroflowmetry charts were checked by a single urologist (LC) who was blinded to the subject's real sexual status.

All subjects were instructed to freely void without increasing abdominal pressure and to subsequently repeat a standard measurement if the voided volume was <150 ml.

All results are expressed as median (range) and mean ± SD. Data presented a non-normal distribution and the non-parametric Wilcoxon match-paired test for paired data and the Kruskal–Wallis test for unpaired data were used for statistical analysis. A *P*-value of <0.05 was considered statistically significant.

RESULTS

Eighteen subjects completed the study (1 was excluded for a newly diagnosed urethral stricture, 7 were excluded for difficulties adhering to the ejaculatory regimen required by the protocol, 1 was excluded for involuntary nocturnal ejaculation). Mean age was 27.4 years, mean IPSS was 0.1 ± 0.47 and mean IIEF was 64 ± 4. Baseline screening also revealed that the mean prostatic volume was 24.7 ml ± 6 without PVR (Table I). Each participant collected 23 uroflowmetry curves, and returned them to the investigators at one time, together with the corresponding completed questionnaires. All the volunteers were able to perform the uroflowmetry between 2 and 3.5 hr after the ejaculation. Final analysis was based on a total of 414 flows collected from all participants (Table II).

The mean Qmax at baseline (T-1) was 22.7 ± 5.4 ml/sec, while after the enrollment and the first ejaculation (T0) it increased to 25.7 ± 8 ml/sec with a statistically significant difference ($P = 0.0029$) (Fig. 1). Also the mean Qmax at T5 (1 week of abstinence) was 23.2 ± 5.4 ml/sec and significantly increased to 25.4 ± 8 ml/sec in T6 ($P = 0.031$). The same effect was also detected at the end of the 2-week period of sexual abstinence. In fact, at T21, after 14 days of sexual abstinence the mean Qmax was 21 ± 4.8 ml/sec and it increased to 24.5 ± 7.9 ml/sec after the T22 ejaculation, which represents a statistically significant difference ($P = 0.031$). Overall, those data suggest that a significant increase in Qmax value was observed after ejaculation in young healthy men, in fact, maximum flow rate was greatest in the days following ejaculation in all the subjects evaluated. Pooling together the Q max values in T0, T6, and T22 (ejaculation) and comparing them to the Q max values in T5 and T21 (maximal abstinence) we found that ejaculation is associated to a significant ($P = 0.001$) increase of 15.7% in Qmax (3.3 ml/sec, range −0.7 to 5.8).

On the contrary, sexual abstinence (7 and 15 days) resulted in a progressive, statistically significant decline in Qmax rates (T0 Qmax 25.7 ± 8 vs. T5 23.2 ± 5.4 $P = 0.035$; T6 Qmax 25.4 ± 8 vs. T21 Qmax 21 ± 4.8, $P = 0.01$). Long-term abstinence was also associated with a significant decrease in urinary flow rates (T5 vs. T21; $P = 0.028$). This data was evident in all the subjects (Fig. 1). Median PVR was 0 ml (range 0–30 ml) for all the flow traces (Table I).

DISCUSSION

Urinary flow rate is considered as a relatively reliable and reproducible means of assessing voiding parameters.[2] Uroflow has also shown a remarkable consistency in the first and repeated voids in normal men and women.[5] It has been reported that a circadian rhythm in urinary flow is present in men with high grades of bladder outlet obstruction, however the mean and maximum flow rates in men without obstruction were not significantly different between specific daytime periods.[11] Until now no trial has demonstrated an influence of ejaculation on uroflowmetry parameters, although no study had been specifically designed to answer this question.

In our study, the normal variation that exists in uroflowmetry parameters in a cohort of healthy asymptomatic young men (who happened to be urology residents or medicine students) was examined. In an effort to limit the, yet unproven, influence, of exogenous daily encounters events, we designed a prospective study in which ejaculation was permitted only in specific days. Our results led to the conclusion that among healthy young individuals, with no history of urinary

TABLE I. Patients' Uroflowmetry Parameters. Ejaculation Occurred on T0, T6, and T22. (Median Values With Range of Qmax, Voided Volume and PVR During the Study Period)

	T-1	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22
Median (range) Qmax (ml/sec)	21.8 (16–38)	23.5 (17–40)	22 (10–29)	20.5 (9–32)	21.6 (15–40)	20.8 (13–40)	22 (15–39)	22 (13–39.8)	19.4 (14–43)	19.1 (14–41)	19.5 (15–40)	19.8 (14.3–41)	19.6 (15–40.8)	19.7 (15–24)	17.9 (13.6–40.5)	18.5 (15.4–38.4)	20 (15–39.7)	18.4 (12.8–35)	20.2 (17.2–39–5)	19.7 (16.3–39.6)	20.5 (15.4–36.1)	20.8 (11.1–38.8)	20.9 (11.6–31.4)	23.1 (16–40.2)
Median (range) Qvolume (ml)	295 (180–494)	293 (199–589)	307 (186–583)	282 (137–650)	300 (168–600)	272 (179–528)	258 (189–503)	280 (173–484)	284.5 (210–527)	274.5 (170–613)	280 (137–539)	310 (97–585)	312 (220–547)	234 (146–494)	273 (140–600)	253 (171–375)	292 (171–398)	251 (177–431)	311 (194–502)	270 (144–447)	252 (148–383)	297 (151–451)	309 (155–443)	302 (245–560)
Median (range) PVR (ml)	0 (0–20)	0 (0–20)	0 (0–15)	0 (0–20)	0 (0–20)	0 (0–15)	0 (0–20)	0 (0–20)	0 (0–30)	0 (0–20)	0 (0–20)	0 (0–20)	0 (0–20)	0 (0–20)	0 (0–15)	0 (0–20)	0 (0–15)	0 (0–20)	0 (0–15)	0 (0–20)	0 (0–15)	0 (0–15)	0 (0–30)	0 (0–20)

TABLE II. Qmax (ml/sec) Values for Each Patient During the Study Period (T0, T6, and T21 Represent Uroflowmetry Assessment After Ejaculation)

	T-1	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22
#Pts																								
1	20.80	29.10	30.00	20.00	21.80	20.90	25.40	19.80	18.30	16.10	19.60	21.00	21.30	21.30	17.90	16.00	20.80	18.40	19.00	17.00	18.10	18.10	18.40	23.20
2	28.00	33.00	24.90	28.90	25.90	17.90	28.10	33.00	23.80	27.70	25.10	27.70	28.00	20.20	24.70	28.70	24.30	28.60	23.70	28.90	25.40	30.80	23.40	24.40
3	18.50	30.30	20.60	25.10	26.00	23.60	25.90	29.90	23.50	21.60	21.80	25.50	24.10	22.20	16.60	19.30	24.70	19.50	19.90	20.00	22.60	21.90	15.60	24.00
4	15.80	17.30	23.10	15.30	18.10	18.90	22.40	19.30	19.90	19.30	20.60	21.30	21.50	22.30	19.60	18.00	20.10	20.70	21.60	21.00	21.60	22.30	18.30	24.00
5	18.20	16.40	18.10	16.10	16.10	17.10	18.40	19.00	16.90	16.00	14.90	14.30	15.70	16.00	17.00	15.80	16.30	18.10	18.10	17.60	16.90	20.20	20.00	25.00
6	38.10	40.00	29.00	32.00	43.00	22.50	39.00	39.80	43.30	41.00	40.00	41.00	40.80	24.00	40.50	38.40	36.30	35.00	39.50	39.60	36.10	34.50	31.10	40.20
7	30.80	39.80	29.00	32.00	26.60	40.00	22.70	37.00	36.00	36.00	33.20	40.30	34.30	24.00	31.90	36.30	39.70	35.00	28.10	26.60	33.80	38.80	31.40	37.00
8	26.30	27.90	17.80	20.10	24.10	23.70	15.20	26.80	17.10	20.40	20.90	21.70	25.20	22.50	25.90	25.40	23.90	16.10	21.60	24.20	20.00	23.70	17.10	16.00
9	17.10	19.80	22.80	16.90	15.40	12.90	19.10	13.10	16.00	14.00	14.40	14.40	15.00	11.60	13.60	16.90	15.80	12.80	19.90	19.40	15.40	11.10	11.60	23.00
10	21.80	19.10	21.80	17.30	20.70	21.20	20.10	38.10	17.30	16.40	20.40	18.80	15.40	16.90	18.50	19.30	19.90	19.80	21.00	16.30	16.60	19.50	23.10	22.00
11	15.90	17.60	21.60	19.40	19.20	20.80	27.30	24.30	20.10	19.20	19.20	23.60	21.30	20.90	18.60	20.40	19.20	18.10	20.60	17.10	17.60	20.20	17.30	24.00
12	23.50	34.10	20.00	20.00	21.80	20.90	29.40	19.80	18.30	16.10	19.60	21.00	21.30	21.30	17.90	16.00	20.80	18.40	19.00	17.00	18.10	18.10	18.40	23.20
13	21.00	20.20	20.00	18.00	21.00	19.90	19.00	18.30	19.00	20.00	18.40	18.20	17.00	17.20	16.00	15.40	15.00	16.00	17.20	18.00	19.40	20.00	20.80	22.00
14	21.00	22.70	22.50	21.00	21.30	20.80	19.00	25.00	13.50	18.50	19.50	18.50	18.00	17.00	16.30	16.00	17.20	18.00	19.40	19.50	20.00	20.00	21.00	20.50
15	21.80	23.00	22.00	23.00	21.50	20.00	20.50	19.80	19.00	18.70	18.00	17.50	17.16	15.00	15.00	16.00	17.50	18.20	19.80	20.00	21.00	21.50	22.00	22.40
16	24.00	23.00	22.00	23.00	20.00	20.40	20.00	26.00	20.50	19.00	19.00	18.20	17.80	16.50	15.90	16.00	16.20	15.90	17.60	19.00	21.50	20.00	21.00	20.50
17	23.90	25.20	25.00	24.00	23.70	22.00	22.90	22.00	23.00	20.00	19.20	18.00	17.00	17.04	18.30	19.00	20.00	20.70	20.60	23.00	21.20	22.90	24.00	23.40
18	23.70	24.20	24.00	23.00	22.00	21.00	21.70	25.00	22.00	19.00	19.20	17.00	16.40	16.20	18.00	19.00	20.00	21.70	21.60	22.00	22.20	23.90	24.00	24.50
Mean (ml/sec)	22.7	25.7	24.0	23.2	24.2	21.6	23.2	25.4	21.5	21.8	22.35	22.9	21.7	19.68	21.5	20.6	21.5	20.6	21.5	21.7	21.5	22.9	21	24.5
DS	5.4	8	7.6	9	12	6.2	5.4	8	7.2	9.6	10	10	7.8	2	11.8	7	6.6	6.1	5.11	6.8	5.4	7.1	4.8	7.9

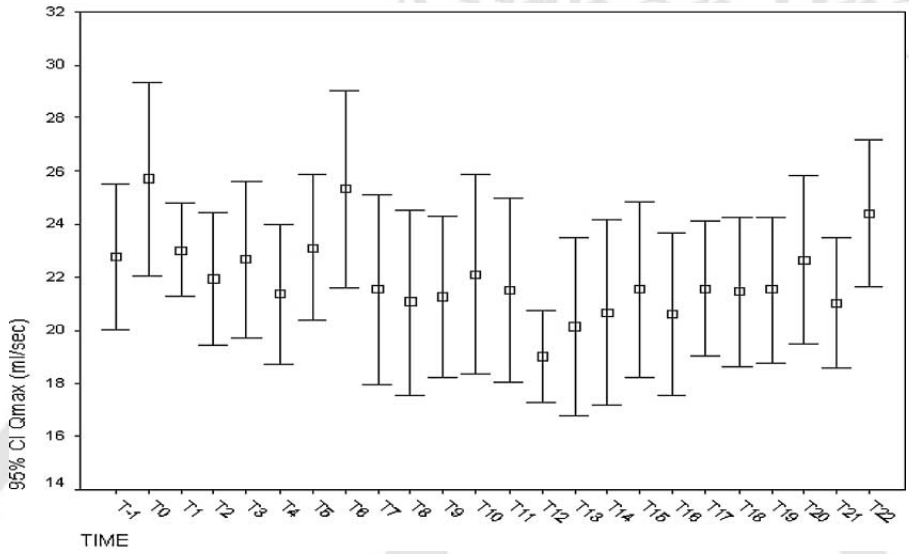

Fig. 1. Qmax (ml/sec) and error bar for each patient during the entire study period (T0, T6, and T21 represent uroflowmetry assessment after ejaculation).

dysfunction, there is a significant variation in the so-called "normal flow parameters" in relation to ejaculation.

Our results showed that the Qmax value significantly fluctuates in a cohort of young healthy males; in particular it decreases during progressive sexual abstinence and increases after ejaculation.

Since the 1970s a variety of conditions have been considered as possible factors negatively affecting the reliability of uroflowmetry.[6–10] Among these, sexual activity, recorded in a middle-aged asymptomatic cohort of volunteer male urologists, has been evaluated by a self-reported questionnaire as a potential confounder.[9] Unfortunately, the number of "events" was too low to allow for any meaningful conclusions, and the authors concluded that none of the variables studied had a significant influence on peak flow rates.

Herein, we found a statistically significant difference in Qmax of about 3 ml/sec between pre and post-ejaculation. Does sexual abstinence influence LUTSs and micturition? Judging from our data it is reasonable to at least consider sex abstinence as a potential confounder in interpreting uroflowmetry traces. A possible explanation of this phenomenon should be sought at the level of production, storage, and ejection mechanisms of the prostatic secretions. A cycle of production and storage of prostatic fluid followed by regular secretion seems to be the basis for a healthy prostate. In fact, some authors have looked at the frequency of ejaculation as a key point to trigger the pain and other symptoms related to the chronic pelvic pain syndrome. They showed that normal-regular sexual activity decreases the incidence of prostatic inflammation and they encouraged regular ejaculation.[12] On the contrary, others have hypothesized that frequent ejaculation could be associated with a non-infectious inflammation of the prostate because of a local increase in the production of free radicals and lactic acid with associated local cellular/tissue damage resulting in inflammation, muscular fatigue, and dysfunction.[13]

Moreover, for the relief of symptoms of chronic prostatitis, it has been recommended that patients should regularly undergo prostatic massages, particularly for those with a large, congested and painful gland. The therapeutic benefit from prostatic massage was believed to derive from a combination of several factors, including drainage of infected prostatic fluid, built-up of pus and dead cells, relief of pelvic muscle spasm, physical disruption of any protective biofilm, improved circulation, and consequently improved antibiotic penetration.[14–16]

Finally, the administration of α-blockers in patients with chronic pelvic pain syndrome has been proposed and is in use since the 1990s.[17–18]

Taken together, all this evidence highlight the fact that urinary symptoms and urinary flow rate are important parameters for patients with prostatic inflammatory diseases and that they could probably be influenced by regular ejaculation and expression of prostatic secretions.

In designing this study, we also acknowledge the circadian rhythm of voiding patterns and this is the reason why all flow rates were measured in the morning in all subjects and why each subject entered the study (T0) on the same day of the week. Although, one could consider the observed mean change in Qmax as clinically minimal; this difference is between 2.5 and 3.5 ml/sec, which is greater than that observed after treatment with alpha-blockers notwithstanding the "learning effect" that per se should make the flow rate better day after day. The point is not how great is the difference in absolute numbers, rather it is about the fact that this difference is statistically significant and greater than that observed following pharmacotherapy[19–22] and that it remains of interest notwithstanding the obvious study limitations. Data from studies evaluating the effects of alpha-blocker therapy showed a significant flow rate improvement by 16–25% compared with placebo.[19] The more recent data (from MTOPS and CombAT studies) showed a Q max increase of about 1 ml/sec in subjects with LUTS treated with α-blockers.[20–22] However, in all these studies the sexual status and activity of patients has never been considered as a possible bias or as inclusion/exclusion criteria for enrolment. One can speculate from our data that ejaculation or abstinence can significantly influence urinary flow rate and that it should be considered as a possible confounding factor when evaluating urinary flow traces especially in the setting of clinical studies evaluating new treatment modalities. Obviously, our data do not invalidate the results of clinical trials on pharmacological management

of LUTS but provide an interesting insight into the pathophysiology of voiding dynamics and raises an issue in the design of future clinical trials. Furthermore, our data, if confirmed by further studies on patients with LUTS, could particularly be of relevance in older patients who present with longer periods of sexual abstinence compared to younger men.[23]

In this preliminary study in healthy volunteers, it was very interesting to find that urinary flow varied clearly and significantly depending on ejaculatory status, the reason remains to be studied, although a possible relationship with the congestion of the gland related to the excessive and prolonged storage of prostatic fluid can be hypothesized. Moreover, one could argue that the proposed positive effect of PDE-5 inhibitors on urinary symptoms is mediated through increased rates of sexual intercourse and subsequent ejaculation.[24]

Limitations of our study include the relatively small number of patients enrolled and that individual variability related to uroflowmetry could not be excluded. Furthermore, our entire study population consisted of young, sexually active, and urinary-symptoms-free subjects and so far, the possible influence of prostatic enlargement or bladder prostatic obstruction on our results cannot be guessed. In order to overcome this limitation a new study has been designed to test the same hypothesis in an elderly population with significant incidences of both LUTS and sexual dysfunction. However, the academic question that initiated the present study stems from the serendipitous observation of better flow rates following ejaculation. The aim of the study was therefore to prove that ejaculation results in a statistically significant change of Qmax compared to flow rates measured after a period of sexual abstinence. Although, data distribution is not normal and the number of subject study is limited by the fact that they were volunteers, there is a clear take-home message: flow rates improves following ejaculation.

CONCLUSIONS

In this preliminary study in healthy volunteers, we found that the urinary Qmax flow rates varied significantly according to ejaculatory status. Although the reason remains to be studied, if confirmed in larger series of patients with LUTS, our findings support the idea that the sexual status and activity could represent a possible confounding factor in the interpretation of uroflowmetry traces.

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