

Effect of Sildenafil on Penile Plethysmography Responding: A Pilot Investigation

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Abstract Despite the utility of penile plethysmography in helping diagnose sexual offenders, some men respond minimally to the test stimuli. This pilot investigation examined the effect of sildenafil on phallometric responding in a non-forensic sample ($n = 12$) of middle-aged males. Participants underwent phallometric testing on two separate occasions and were administered 50 mg of sildenafil prior to one of these sessions. Study data indicated that pre-treatment with sildenafil produced a significant mean percentage increase (28%) in peak response compared with the untreated condition. The implication of this result is discussed in view of the selected sample.

Keywords Penile plethysmography · Sildenafil · Sexual offenders

Introduction

The phallometric test (penile plethysmography) is a psychophysiological tool used to assess the erotic age and gender preferences of adult males. In volumetric phallometry, the penile blood volumes of patients are measured in a laboratory setting while they are exposed to a standardized set of sexually themed stimuli depicting adults and children. Increases in penile blood volume correspond to the patients' relative attraction to the different categories of persons. Several reviews addressing the use of phallometric testing in clinical diagnosis exist (Harris & Rice, 1996; Lalumière &

Harris, 1998; Launay, 1999). About 10% of males undergoing phallometric testing show no clinically meaningful response to any of the gender or age categories (Blanchard, Klassen, Dickey, Kuban, & Blak, 2001). Lack of response in these individuals may be due to a constellation of factors, including neurological, vascular, or hormonal abnormalities. Sildenafil (Viagra) has been shown to increase the potential for erection in sexually stimulated males through indirect relaxation of penile erectile tissue (Seftel, 2005). We therefore hypothesized that administration of sildenafil to participants prior to phallometric testing would produce quantitative increases in penile blood flow measured during phallometry compared with testing without sildenafil.

Method

Participants

This study was approved by our institution's research ethics board. Men between the ages of 40 and 65 years who responded to recruitment advertisements posted in the hospital were eligible to participate. The recruitment poster indicated that the study investigators were investigating male patterns of sexual arousal in response to a single dose of sildenafil. Potential male participants between 40 and 65 were requested to contact the lead investigator (NK) by telephone or email for further information. When potential participants contacted the lead investigator, they were given more detailed information on the study protocol, including a description of the phallometric method. The pre-screening procedure was limited to asking potential participants whether they currently lived with children, which was an exclusion criterion of the study. One individual was excluded from participation on this basis.

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Candidates were excluded from participation on the following bases: (1) non-fluent in English; (2) presence of psychotic disorder; (3) legal blindness or deafness; (4) IQ < 70; (5) serious cardiac, hepatic, ophthalmic, or renal illness; (6) history of priapism; (7) current use of sildenafil or similar medications; (8) allergy to sildenafil citrate or similar medications; (9) current use of nitrates or other medications known to interfere with the metabolism of sildenafil citrate; and (10) current residence in a household with children. We imposed the last criterion to preclude any obligation on the part of the study investigators to contact authorities should participants' self-reports and phallometric data suggest they present a danger to children. The presence of psychotic disorders was ruled out clinically during the history. Diagnoses of mental retardation (e.g., IQ < 70) were similarly excluded on clinical grounds. Individuals with intellectual disabilities manifest difficulties in communication, display impaired social skills, and present with compromised daily living skills. As the overwhelming majority of developmentally delayed adults either live with or are supervised by family members (Seltzer, Begun, Seltzer, & Krauss, 1991), it is unlikely that these individuals would present for assessment alone. All participants received a complete history and physical by the lead investigator in addition to routine bloodwork, urinalysis, and electrocardiogram. Candidates with potentially serious medical disease revealed during the history were excluded from participation if they had grossly abnormal physical examination findings or laboratory results.

Twenty-one participants began the study. Four individuals were disqualified based on study exclusion criteria: two had poorly controlled hepatitis C infection, one was recovering from a major cardiovascular surgery, and one participant was already taking a pro-erectile medication related to sildenafil. Five participants were lost to follow-up leaving a final sample size of 12. Among those who completed the study, four participants had received previous inpatient and outpatient treatment for alcohol abuse or dependence; two individuals admitted to continued heavy use of the substance. Three participants suffered from mood disorders with two taking antidepressant medication. One individual had well-controlled hepatitis C with near normal liver enzymes, while another had a previous gastrointestinal cancer.

Measures

Each participant served as his own control for the study. Participants were administered 50 mg of sildenafil 1 h prior to either the first or second phallometric testing sessions; the order of drug and non-drug conditions was balanced among participants. Testing sessions were separated by at least 48 h to ensure that drug metabolites were sufficiently cleared from the participants' systems.

The test stimuli were audiotaped narratives presented through headphones and accompanied by slides of nude models. There were seven categories of narratives, which described sexual interactions with prepubescent girls, pubescent girls, adult women, prepubescent boys, pubescent boys, and adult men as well as solitary, nonsexual activities or "neutral" stimuli. All narratives were written in the second person and present tense and were approximately 100 words long. Readers are referred to Blanchard et al. (2001) for specific details on procedures used in this study for the quantification of phallometric response.

Results

Twelve males participated in this open label, pilot investigation. The mean age of the sample was 50.5 ± 5.5 years (range 42–58). There were 11 self-identified heterosexuals and one homosexual. All participants denied a history of sexual offending and claimed a sexual preference for the mature adult physique. Participants' penile responses to each stimulus (e.g., picture of nude model) were quantified as the apogee of the curve of blood volume change in cubic centimetres occurring during each exposure. The mean of the participants' three highest cc scores for all test stimuli was calculated as the output index (Freund, 1967). The overall mean output index for all participants in the untreated condition was 5.8 ± 4.2 cc, while the overall mean output index for participants in the drug condition was 6.7 ± 4.7 cc. Individual results with and without sildenafil treatment are presented in Table 1. To control for between-subjects variability in output index, we expressed treatment effect as the percentage

Table 1 Mean output indices for participants in sildenafil and untreated conditions

Subject	OI sildenafil	OI untreated	Percent change ^a
1	6.31	5.86	7.68
2	6.26	6.75	-7.26
3	6.23	3.29	89.36
4	2.76	2.37	16.46
5	18.38	9.00	104.22
6	2.69	2.70	-0.37
7	8.34	10.37	-19.58
8	12.82	15.83	-19.01
9	5.07	3.14	61.46
10	6.41	5.76	11.28
11	3.73	2.81	32.74
12	1.86	1.20	55.00
<i>M</i>	6.74	5.76	27.67
<i>SD</i>	4.71	4.24	41.33

^a (Sildenafil - untreated)/untreated \times 100

increase in response in the sildenafil condition relative to the untreated condition. Comparing the mean percentage increase against an expected value of zero using a one-sample *t* test, we found a 28% increase in responding with sildenafil, $t(11) = 2.32, p = .041$, two-tailed. There was only a 4% increase in responding from the first to second testing sessions, which was not significant, $t(11) < 1$.

Discussion

The results of this preliminary investigation provide evidence that low dose sildenafil has the ability to increase penile blood flow in males during phallometric testing. As forensic patients referred for assessment before or after sentencing comprise the majority of individuals presenting for phallometric testing, poor responding becomes problematic, especially when such data are required for sentencing or treatment recommendations. Administering sildenafil to patients prior to testing could potentially ameliorate inadequate or non-response. Our sample contained older males with high levels of medical comorbidity and substance misuse, which is relevant because sildenafil appears to be less effective in treating older versus younger men with erectile dysfunction (ED) due to various physical etiologies (Monga, Bettencourt, & Barrett-Connor, 2002). Researchers have also observed that sildenafil can increase erectile activity in young, healthy, potent males who would be more closely matched to patients presenting for phallometric testing (Salonia et al., 2005). Our sample was, therefore, biased against detecting a positive effect of sildenafil.

Very few placebo-controlled studies of sildenafil have examined objective measures of the drug's effectiveness. For example, the majority of studies investigating the clinical efficacy of sildenafil in ED have used standardized, self-reported measures of erectile function as study endpoints (Carson, 2003). One randomized, double-blind, placebo-controlled crossover study of sildenafil in men with ED used circumferential penile plethysmography to test whether sildenafil could increase the mean duration of erections with $\geq 60\%$ rigidity (Gingell, Sultana, Wulff, & Gepi-Attee, 2004). Penile erectile activity was measured at several time points after administration of sildenafil; participants selected from a variety of sexually explicit films to view while their erections were being monitored. At 1 h post-administration of sildenafil, the mean duration of erections in the drug condition was 26 min compared with 3 min in the placebo condition ($p \leq .0001$). Although these investigators tested a higher dose of sildenafil (100 mg), a dose-dependent relationship has been observed for sildenafil and penile rigidity in men with ED: another placebo-controlled cross-over study which employed circumferential phallometry found that the mean duration of rigidity $> 80\%$ at the base and tip of the penis

increased in incremental fashion to increasing doses of sildenafil (10, 25, and 50 mg). All results were significantly greater than those obtained under placebo (Boolell, Gepi-Attee, Gingell, & Allen, 1996). These findings suggest that placebo responding is minimal in studies of sildenafil where relatively objective techniques are used to measure penile erectile activity. However, as the samples in the foregoing studies were confined to men with ED, these results may not be entirely generalizable to our study which included only one participant with ED. To the best of our knowledge, there have been no phallometric investigations that have studied the effect of sildenafil in heterogenous, non-clinical samples.

There are two main scenarios where an intervention like sildenafil that could potentially convert phallometric non-responders to responders would be most beneficial. The first would be in situations where men who were low responders at baseline were falsely labeled as being pedophiles. Administering sildenafil to these individuals prior to phallometric testing could increase their responding to a level where their sexual preference for the mature physique became readily apparent. The second scenario would be insufficient phallometric responding in men who are true pedophiles. In this instance, sildenafil pre-treatment might improve the phallometric test's sensitivity for detecting pedophilia. While the theoretical possibility of sildenafil increasing the rate of false positives exists, it must be emphasized that phallometric testing is only one component in the global assessment of sexual offenders that includes a thorough clinical assessment and detailed sexual history. Without compelling evidence to make a clinical diagnosis of pedophilia, a phallometric diagnosis of pedophilia that was obtained with or without sildenafil would be easily discounted.

While our study suffered from a small sample size and an open design, the results are very encouraging given that they likely constitute an underestimation of the drug's potential effect. These initial findings suggest that administering sildenafil to patients who are unlikely to respond (e.g., older males) could be a useful intervention in phallometric testing. We anticipate conducting future randomized and placebo-controlled trials of sildenafil in phallometric testing with larger samples.

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