

PSYCHOLOGY

Androgen Deprivation Alters Attention to Sexually Provocative Visual Stimuli in Elderly Men



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ABSTRACT

Introduction: Testosterone is known to regulate male sexual interest, but the exact way that androgens influence men's sexual cognition remains unclear.

Aim: To investigate the influence of androgen deprivation (AD) on visual responses to sexually suggestive stimuli in men treated for prostate cancer with AD therapy.

Methods: Patients with AD-treated prostate cancer, patients with prostate cancer not on AD therapy, and age-matched healthy control participants were exposed to images of male and female runway models fully or minimally clothed. Eye tracking was used to compare looking behavior among groups.

Main Outcome Measures: Proportion of fixations on fully clothed vs minimally clothed models and proportion of fixations on target areas of interest (ie, legs, chest, pelvis, and face) of fully clothed and minimally clothed models were analyzed and compared among groups.

Results: Although men not on AD exhibited a larger proportion of fixations on the minimally clothed compared with the fully clothed images, there was no difference between the 2 image types for men on AD. This was true regardless of whether the images depicted male or female models. Groups did not differ in their fixations to target areas of interest.

Conclusion: These results suggest that testosterone can influence men's visual attention to sexual stimuli; specifically, AD can attenuate the time spent fixated on sexualized targets. **Palmer-Hague JL, Tsang V, Skead C, et al. Androgen Deprivation Alters Attention to Sexually Provocative Visual Stimuli in Elderly Men. Sex Med 2017;5:e245–e254.**

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Key Words: Androgen Deprivation; Testosterone; Eye Tracking; Visual Attention; Cognition; Sexual Desire

INTRODUCTION

Men's sexual cognition is presumed to be regulated by hormones, but surprisingly little behavioral research has been done to elucidate this relationship. Although the involvement of

testosterone (T) in men's sexual behavior has been well established,¹ the psychological mechanisms underlying men's sexual motivation have not. In this study, we took a biopsychosocial approach to examine the role of T in the facilitation of sexual desire in men receiving androgen deprivation (AD) therapy for the treatment of prostate cancer (PCa).

A considerable body of evidence implicates T in the facilitation of social interaction, particularly with regard to the evaluation and response to signals of formidability and threat in other men.^{2,3} However, little is known about how T influences the interpretation of cues important for other types of human social behavior, such as sexual attraction and interest. For example, although brief interactions with women lead to increases in T and engagement in risky or "show-off" behaviors in healthy heterosexual men,^{4,5} it is unclear whether T also facilitates the initial cognitive processing of sexual signals. This possibility warrants further study.

T has been routinely associated with sexual responses in men developmentally and in adulthood.^{6,7} In particular, it appears to

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facilitate sexual interest. Decreased interest has been shown in hypogonadal men, and increased interest has been reported in healthy men being treated with experimental T supplements. Importantly, these reports are independent of actual sexual activity, suggesting that in addition to peripheral physiologic processes (eg, sustaining the rigidity of an erection), T is important for the generation and maintenance of sexual arousal and motivation.

Sexual arousal is believed to involve 2 stages of information processing: automatic and controlled.⁸ Automatic processing takes place first and involves rapid, unconscious (ie, involuntary) responses to relevant sexual stimuli. The processing at this stage involves encoding the stimuli and matching the stimuli with existing, meaningful knowledge in memory. Once sexual stimuli are associated with meaning, physiologic (eg, genital) responses are triggered and information proceeds to the next stage. Controlled processing at this stage involves conscious (ie, voluntary) attention toward the stimulus and associated emotional responses. At this point, individuals form a subjective experience of being sexually aroused (or not), because they are aware of the stimulus and their physiologic response to it. This ultimately leads to the coordination of approach (or avoidance) behaviors, facilitating (or hampering) reproduction. Importantly, T could be involved in either or both of these stages.

Eye tracking provides an ideal method for assessing cognitive processing of sexual stimuli. It allows researchers to quantify an individual's visual attention (ie, spatial locations they are looking at), duration of fixation (ie, how long they look), and even pupil dilation.^{9,10} Eye tracking also is relatively simple to use and non-invasive.

Previous research using eye tracking has shown that heterosexual men attend rapidly and specifically to women's bodies, particularly when the models are nude compared with fully clothed.^{9,11,12} In addition, compared with women, men tend to focus their attention on regions of the female body that signal health and fertility, such as the face, breasts, and midriff.^{12–14} Fixation on these areas also correlates with sexual interest as measured by changes in pupil diameter¹² and penile plethysmographic data.¹⁵

Recent studies also suggest important sex differences in processing of visual stimuli. For example, Huberman et al¹⁶ showed that in heterosexual men genital responses positively predicted self-reported arousal from explicit videos depicting women. Further, they found that this effect was mediated by self-reported attention to the stimuli. The influence of self-reported attention was not significant for women, suggesting that T could underlie some cognitive mechanisms associated with sexual arousal. One possibility is in orienting early attention to, or the automatic processing of, sexual cues presented visually. Specifically, Dawson and Chivers¹⁷ found that when viewing sexually explicit films, heterosexual men oriented significantly faster to female than to male targets, whereas heterosexual women did not exhibit a sex-of-target bias. Because automatic processing of sexual

stimuli is believed to activate genital response and subsequent sexual arousal, it is plausible that T facilitates these early actions.

To our knowledge, only 1 study has directly investigated the relation between T and processing of sexual stimuli in healthy men using eye tracking. Rupp and Wallen¹⁸ found that endogenous T levels in healthy young men significantly predicted the amount of time they spent fixated on erotic still images of heterosexual couples engaged in sexual activity. It is important to note that this relation was significant only during the last of 3 test sessions. They suggested that this might have been due to the small sample ($N = 15$), which likely precluded significance in the prior 2 sessions. In addition, when men who reported using erotica outside the study were compared with men who reported not using it, the link between T and time spent fixated on the images was strengthened. Given the reciprocal relation between T and sexual behavior in men (reviewed by Zitsmann and Nieschlag¹⁹), these results support the hypothesis that T could be directly involved in men's controlled attentional processing of sexual images.

Patients treated for PCa provide an ideal study population for the influence of T on attention to sexual images. This is because approximately half of all patients with PCa at one time or another are offered AD therapy to treat their disease. AD is used as adjuvant therapy to improve the effectiveness of radiotherapy for localized disease or to treat the disease when biochemical markers suggest that it is no longer localized. AD is the main pharmaceutical treatment for PCa and some patients can be on and off AD treatment for years when they are otherwise asymptomatic from the disease itself.

T deprivation in patients with PCa is implicated in sexual dysfunction. Men deprived of androgens consistently exhibit depressed sexual function, decreased sexual interest, and other side effects.^{20–24} Similarly, healthy men with pharmacologically induced hypogonadism report significant decreases in sexual cognition, sexual arousal, and sexual drive.^{25,26} Although it is unclear whether these issues are directly related to T rather than to other circulating hormones (eg, estradiol), restoring baseline T levels leads to full recovery of these functions, whereas restoring baseline estradiol levels does not.²⁵ This suggests a key role for T levels in facilitating sexual interest in men. Aside from 1 recent case study of a man receiving AD as treatment for pedophilia,²⁷ we are unaware of any studies that have directly investigated cognitive processing of sexual stimuli in hypogonadal men. Conversely, men with sexual dysfunction can show decreased visual attention to sexual images,²⁸ demonstrating that altered sexual cognition also can occur in this population.

In the present study, we used eye tracking to evaluate cognitive processing of sexually provocative stimuli in men undergoing AD therapy to treat PCa. We compared the number of gaze fixations and length of time spent fixated on minimally clothed (MC; ie, wearing a sexually provocative swimsuit) and fully clothed (FC; ie, wearing regular, not sexually provocative, clothing) male and female models in men being treated with AD

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