



Visual hot spots: An eye tracking study of attention bias in body dysmorphic disorder



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ABSTRACT

Attentional biases have been implicated in the development and maintenance of BDD. In particular, a visual attention bias toward one's unattractive features and others' attractive features (negative bias), might underlie BDD symptoms. Healthy individuals typically pay more attention to others' unattractive and their own attractive features (positive bias). This study used eye tracking to examine visual attention in individuals with BDD relative to healthy controls (HC). We also explored the role of avoidance in attention bias. Participants with BDD and primary face/head concerns ($n = 19$) and HC ($n = 20$) completed computerized tasks and questionnaires. Eye movement data (i.e., fixations, dwell time) were recorded while participants viewed images of their own and a control face (selected for average attractiveness and neutral expression). Participants rated distress and perceived most and least attractive features of their own and another face. BDD participants demonstrated a negative mean total bias score compared to HC (fixation: $p = 0.24$; dwell: $p = 0.08$). Age (fixation: $p = 0.006$; dwell: $p = 0.03$) and gender (fixation: $p = 0.03$; dwell: $p = 0.03$) moderated the relationship. Avoidance was associated with a positive bias in BDD. Results suggest individuals with BDD overfocus on negative attributes, a potential factor in the disorder's etiology and maintenance. Conversely, HC had a more balanced focus on their traits. Elucidating the role of attention bias could help to identify risk and maintenance factors in BDD.

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Body dysmorphic disorder (BDD) is characterized by preoccupation with a perceived defect in one's appearance that causes clinically significant distress and/or functional impairment. BDD is common, affecting an estimated 1.7–2.4% of the population (Buhlmann et al., 2010; Koran et al., 2008; Rief et al., 2006). Thus, identification of risk factors and effective treatment strategies are critical.

Cognitive models of BDD (e.g., Veale, 2004; Wilhelm et al., 2013) implicate attention bias in its etiology and maintenance. Individuals with BDD selectively attend to specific aspects of one's appearance or minor appearance flaws. This is supported by clinical observations and neurocognitive (e.g., functional magnetic resonance imaging [fMRI]) research findings demonstrating a bias for detailed rather than holistic elements of visual stimuli

(Deckersbach et al., 2000; Feusner et al., 2007, 2010a, 2010b). For example, using fMRI to examine information processing in BDD, Feusner et al. (2007, 2010b) found that BDD patients over-utilized the detail-oriented left hemisphere (local processing) compared to controls when exposed to pictures of neutral and their own faces. Increased attention to detail can lead individuals with BDD to overfocus on, and overemphasize the importance of, minor or perceived imperfections in appearance, thereby maintaining and worsening appearance related distress. BDD patients overestimate the importance of perceived imperfections and falsely interpret them as reflective of personal defectiveness and lack of self-worth (Veale et al., 1996) (e.g., "unless I have perfect skin, nobody will ever love me"). Patients react to perceived flaws and related self-defeating interpretations with negative emotions (e.g., anxiety, depression, shame) that further increase selective attention. In an attempt to fix perceived flaws and/or alleviate distress, individuals with BDD engage in time-consuming rituals, including excessive mirror checking (e.g., getting "stuck" in front of the mirror for hours per day) and comparing their own appearance to that of others. In comparison to independent evaluations by individuals without appearance concerns, individuals with BDD tend to underestimate

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their own attractiveness, yet overestimate the attractiveness of other individuals (Buhlmann et al., 2008). Persons with BDD also often avoid social and other trigger situations (e.g., mirrors, eye contact). Feusner et al. (2007) suggested that aberrant emotional information processing in BDD may be mediated by early stage (visual) processing biases. However, past methodologies make it difficult to extricate direct attention processes from verbal stimuli/responses.

Eye tracking provides an opportunity to explore direct attention processes; this approach has been used to study cognitive factors in individuals with eating disorder symptomatology (e.g., Blechert et al., 2010; Jansen et al., 2005; Roefs et al., 2008; Smeets et al., 2011). Findings from these studies with eating disordered individuals suggest that individuals high in body dissatisfaction attend more to their own perceived unattractive features and to the perceived attractive features of others (negative attention bias), whereas healthy controls (HC) demonstrate a positive cognitive bias (i.e., selectively attend to their perceived most attractive part and to the most unattractive part of others). These data demonstrate a tendency toward a negative attention bias among individuals high in body dissatisfaction, and suggest that a negative attention bias may maintain or even play a role in the etiology of body dissatisfaction (Jansen et al., 2005; Smeets et al., 2011). Grochowski et al. (2012) used eye tracking to demonstrate selective attention among BDD patients to parts of concern on their own face and corresponding regions in the faces of unfamiliar individuals. However, this study did not use a validated set of facial stimuli, nor did it allow for examination of avoidance of attractive and unattractive stimuli; avoidance is a prominent feature of BDD, and many patients fluctuate between mirror checking and mirror avoidance (Veale and Riley, 2001).

The primary aim in the current study was to expand upon prior studies using eye tracking to explore visual attention biases in individuals with BDD relative to healthy controls by examining time spent gazing at features in one's own face and an unfamiliar control face. Consistent with clinical observation and previous findings among individuals high in body image dissatisfaction, we hypothesized that BDD participants would focus on self-rated "most unattractive" aspects of their own face and on features they rated as "most attractive" of a control face; thereby demonstrating a negative total bias score (as measured by fixation counts and dwell time) compared to HC participants. We also predicted that individuals without a body image disorder (healthy controls) would focus more on their own attractive features and on the unattractive features of other faces (positive bias). Additionally, we examined the relationship between total bias score, distress, and BDD symptoms. Specifically, we hypothesized that the more negative total bias scores would be associated with greater distress (SUDS) and greater symptom severity (BDD-YBOCS). An exploratory aim was to investigate the relationship between BDD-related avoidance and attention bias. Identifying attentional biases could help elucidate risk factors and modifiable targets for treatment.

1. Method

1.1. Participants

Potential participants were initially screened over the phone and were invited for an in-person evaluation if they met eligibility criteria. Participants were recruited between March 2011 and July 2012 through our clinic, flyers and brochures posted in the community, online advertisements, and referrals from mental health professionals. Participants were enrolled if they were adults (age 18 or older) with normal or corrected to normal vision. Given that facial/head abnormalities are the most commonly cited concern

among BDD participants (Phillips and Diaz, 1997; Phillips et al., 2005) and the face region is comparatively easy to standardize and compartmentalize, we only included BDD participants with a primary diagnosis of DSM-IV BDD with primary facial/head concerns, and a minimum score of 20 on the Yale-Brown Obsessive Compulsive Scale Modified for Body Dysmorphic Disorder (BDD-YBOCS; Phillips et al., 1997). We excluded potential BDD participants with comorbid bipolar disorder (current manic episode), psychosis, current suicidality, current substance dependence disorder, organic mental disorder, or developmental disorder. HC were excluded if they had a past or current psychiatric illness.

Fifty-one individuals signed consent forms and were screened in-person. To minimize potential confounding by age and gender, we recruited HC that would match the distribution of these variables in our BDD participants. Prior to Visit 2, ten participants were excluded: nine were ineligible [face/head not primary BDD concern ($n = 2$), BDD not primary diagnosis ($n = 3$), BDD-YBOCS score < 20 ($n = 2$), current manic episode ($n = 1$), significant neurological condition ($n = 1$)] and one participant dropped out of the study. Of the remaining 41 participants, two participants were excluded from the present analysis due to erroneous eye tracking data. Our final sample consisted of 19 BDD participants and 20 healthy controls.

1.2. Measures

The **Structured Clinical Interview for DSM-IV** (SCID; First et al., 2002), a valid and reliable semi-structured interview and the standard for diagnosing current and lifetime Axis I disorders, was used to diagnose BDD and other disorders and to rule out Axis I disorders in the HC group.

The **Yale Brown Obsessive Compulsive Scale modified for BDD** (BDD-YBOCS; Phillips et al., 1997) is a valid and reliable, 12-item semi-structured clinician-administered measure of BDD symptom severity. Scores range from 0 to 48, with higher scores indicating more severe BDD symptoms.

The **BDD Data Form** (BDDDF; Phillips, unpublished) is a semi-structured instrument that obtains body parts of concern, age of BDD onset, past treatment, and history of suicidality and violence.

The **Brown Assessment of Beliefs Scale** (BABS; Eisen et al., 1998) is a valid and reliable 7-item clinician-administered measure that assesses current insight/delusional beliefs about appearance related beliefs (e.g., "I look deformed."). Scores range from 0 to 24, with higher scores reflecting poorer insight/greater delusional beliefs.

The **Beck Depression Inventory** (BDI-II; Beck et al., 1996), a 21-item self-report inventory, is a widely used measure of depression severity.

The **BDD-Symptom Scale** (BDD-SS; Wilhelm, 2006) assesses severity/existence of specific BDD symptoms. The scale organizes symptoms into organized into conceptually similar clusters (e.g., checking, cognition, avoidance).

The **Subjective Units of Distress Scale** (SUDS) is an idiographic barometer of a subject's distress demonstrating good reliability and validity (Thyer et al., 1984). This 100 point visual analogue scale assesses subjective distress following visual attention tasks (0 = no distress, 100 = extreme distress).

The **Facial Attractiveness Scale** (FAS), a 9-point Likert scale (ranging from 1 = not at all attractive to 9 = extremely attractive), was presented to participants who were asked to select and rate the perceived most attractive and unattractive features of their own and the other face.

Eye Tracking Measurement - Small infra-red cameras on the EyeLink® II eye tracker headset (SR Research Ltd., Toronto, Canada) transmit data regarding head and pupil positions to the eye tracker, and allow for accurate pupil acquisition and gaze tracking with a sampling rate of 500 Hz (i.e., 500 samples per second), a

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