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Altered orienting of attention in anorexia nervosa

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ABSTRACT

The study of cognitive processes in anorexia nervosa (AN) is largely unexplored, although recent evidence suggests the presence of impairments in both social cognition and attention processing. Here we investigated AN patients' ability to orient attention in response to social and symbolic visual stimuli. AN patients and matched controls performed a task in which gaze and pointing gestures acted as social directional cues for spatial attention. Arrows were also included as symbolic cue. On each trial, a centrally-placed cue appeared oriented rightwards or leftwards. After either 200 or 700 ms, a lateralized neutral target (a letter) requiring a discrimination response appeared in a location either spatially congruent or incongruent with the directional cue. Controls showed a reliable orienting irrespective of both temporal interval and cue type. AN patients showed a reliable orienting at both temporal intervals only in response to pointing gestures. Both gaze and arrow cues failed to orient attention at the short temporal interval, that is when attention is under reflexive control, whereas a reliable orienting emerged at the long temporal interval. These results provide preliminary evidence of altered reflexive orienting of attention in AN patients that does not extend to body-related cues such as pointing gestures.

1. Introduction

Anorexia nervosa (AN) is a severe psychiatric disorder which is mainly characterized by a drastic food restriction and a difficulty to maintain a healthy body weight (e.g., Fairburn and Harrison, 2003; Hebebrand and Bulik, 2011). As a consequence, mortality rates among patients with AN is also dramatically high (e.g., Zipfel et al., 2000; Birmingham et al., 2005; Arcelus et al., 2011). Besides the understandable great interest about the clinical aspects of this disorder, such as causes, diagnosis and treatment (e.g., Schmidt and Treasure, 2006; Bulik et al., 2007; Treasure et al., 2010), less efforts have been made to investigate cognitive processes in patients with AN. This lack of empirical studies becomes particularly evident with regard to attentional processes. So far, a number of studies aimed to investigate attention in AN focused on selective attention for biological and social stimuli specifically related to AN, such as food or bodies, revealing the presence of an attentional bias towards these stimuli, at least under some circumstances (e.g., Brooks et al., 2011; Giel et al., 2011; Urgesi et al., 2012; Aspen et al., 2013; Urgesi et al., 2013; Kim et al., 2014). Interestingly, no studies have explored the impact of social stimuli onto orienting of attention in AN. This is somewhat surprising, as the ability to shift the attentional focus in response to spatial cues provided by others represents a key feature of human behaviour (e.g., Baron-Cohen, 1995) which has been shown to be impaired in AN patients, leading them to poor interactions with other individuals (Cipolli et al., 1989; Kucharska-Pietura et al., 2004; Cserjesi et al., 2011). This 'social attention' has been widely investigated in healthy participants by using a modified version of the spatial cueing paradigm (e.g., Posner, 1980), in which eye gaze is used as a directional cue for attention instead of the classic arrow. This is known as the gaze-cueing paradigm (Friesen and Kingstone, 1998; Driver et al., 1999). Typically, this consists of presenting participants with a task-irrelevant centrally-placed facial stimulus with gaze averted either rightwards or leftwards. After a certain temporal interval (Stimulus Onset Asynchrony, SOA), a target requiring a response appears in a spatial location which can be either congruent or incongruent with that indicated by gaze. Typically, lower reaction times (RTs) are observed on congruent rather than on incongruent trials, a result which is interpreted as evidence that gaze cues oriented attention effectively. Indeed, it is assumed that, on spatially congruent trials, participants shift their attention to the target location in advance being pushed by the task-irrelevant directional cue. The gaze-cueing paradigm has been successfully

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employed both in healthy and in clinical populations, other than patients with eating disorders, to investigate many different aspects concerning social attention and social cognition and how their dysfunction influences pathogenesis or maintenance of psychopathology (e.g., Senju et al., 2004; Frischen et al., 2007; Kuhn et al., 2010; Galfano et al., 2011; Dalmaso et al., 2012; Liuzza et al., 2013; Marotta et al., 2013; Dalmaso et al., 2014).

Importantly, evidence is accumulating suggesting that AN patients show impairments in several mechanisms involved in social cognition (Caglar-Nazali et al., 2014), which led some authors to hypothesize a link between AN and autism spectrum disorders (e.g., Zucker et al., 2007; Oldershaw et al., 2011; but see also Adenzato et al., 2012). More specifically, it seems that AN patients would be less sensitive to social signals provided by other's face, such as emotional states (e.g., Kucharska-Pietura et al., 2004; Cserjesi et al., 2011). Furthermore, they would also tend to avoid eye contact with other individuals (Cipolli et al., 1989), exhibiting, instead, an exaggerated tendency to attend to the body of others (Watson et al., 2010). Interestingly, impairments in the processing of eye gaze stimuli have been reported in another psychiatric disorder associated with deficits in social cognition, namely schizophrenia (e.g., Tso et al., 2012). In the domain of attentional processes, schizophrenic patients fail to show a reliable cueing of attention in response to eye gaze as compared to symbolic cues (e.g., an arrow; Akiyama et al., 2008) or pointing gestures (Dalmaso et al., 2013), another social cue which is known to elicit reliable shifts of attention in healthy individuals (e.g., Cazzato et al., 2012; Porciello et al., 2014), despite it does not possess the same communicative richness as eye gaze.

The present study represents the first attempt to investigate spatial cueing of attention in response to social stimuli in AN patients as compared to a matched group of healthy controls. To this end, schematic eye gaze and pointing gestures were employed as social cues in a spatial-cueing task. In addition, arrow cues were also included in order to disentangle between social and symbolic cueing of attention (see also Kuhn and Kingstone, 2009; Galfano et al., 2012). Finally, we included two different SOAs (i.e., 200 ms vs. 700 ms), in order to explore the time course of attentional shifting elicited by these cues, as a short SOA is known to tap onto reflexive attentional control, whereas at longer SOAs more controlled processes are thought to intervene (Müller and Rabbitt, 1989). As for healthy controls, we expected to observe reliable orienting of attention (i.e., lower RTs on congruent than on incongruent trials) irrespective of both SOA and cue type (e.g., Dalmaso et al., 2013). Indeed, task-irrelevant centrally-displayed cues elicit significant spatial cueing effects even at SOAs longer than those used in the present study (e.g., Frischen and Tipper, 2004; Galfano et al., 2012). Based on the notions discussed above, in the case of AN patients, a different pattern of results was expected in relation to gaze cues. Indeed, we predicted a reduced orienting of attention to gaze signals (i.e., no or reduced difference between RTs on incongruent and congruent trials), confirming the alterations reported in AN patients in dealing with this stimulus (e.g., Cipolli et al., 1989). Pointing gestures and arrow cues enabled us to test two additional hypotheses, namely whether attentional deficits extend over other social cues (i.e., pointing gestures) and whether deficits involve higher-order cognitive domains and extend to the processing of symbolic signals (i.e., arrows).

2. Methods

2.1. Participants

Twenty-three AN patients (*Mean age*=26.48 years, *SD*=9.7, *Mean education*=12 years, *SD*=2.92, *Mean Body Mass Index* (*BMI*)=16.2, *SD*=2.65; two males; two left-handed) were recruited from a clinic, located in northern Italy. Fourteen individuals had diagnosis of restrictive subtype and nine were diagnosed with binge-purge subtype. Diagnoses of AN were made by a board-certified attending research team of senior psychiatrists through the Structured Clinical Interview (First et al., 2002) of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV, American Psychiatric Association, 2000). Exclusion criteria were board-certified diagnoses of cognitive or personality disorders, psychosis, mental retardation and major depression. Nineteen individuals were medicated with neuroleptics, antidepressants, neuroleptics combined with antidepressants, or benzodiazepines. Vitamins, diet supplements, gastrointestinal medications were also included in the treatment.

The control group consisted of 23 healthy participants (*Mean age*=25.39, *SD*=5.37, *Mean education*=12.17, *SD*=2.84, *Mean BMI*=20.94, *SD*=2.29; two males; two left-handed), carefully recruited from the local community to perfectly match the AN patients as concerns age, $t(44)=0.470$, $p=0.641$, $d=0.139$, education, $t(44)=0.205$, $p=0.839$, $d=0.06$, gender and handedness. An individual interview was administered to exclude both current and past history of neurological or psychiatric disorders, use of medications, substance abuse, or dependence. BMI of the two groups was different, $t(44)=6.496$, $p<0.001$, $d=1.9$.

All participants had normal or corrected-to-normal vision, were naïve as to the purpose of the experiment and took part on a voluntary basis. The Ethics Committee for Psychological Research at the University of Padova approved the study, and an informed consent was obtained from all participants.

2.2. Clinical measures

AN patients had several clinical measures available which consisted of self-reported tests (see Table 1). The Beck Depression Inventory (BDI-II; Beck et al., 1996) was used to assess the severity

Table 1
Clinical information of AN patients.

Variable	Score	
	M	*SD*
Age of illness onset (years)	18.13	7.12
Duration of illness (years)	8.57	7.82
Beck Depression Inventory (BDI-II)		
Global score	26.96	16.17
Item 9 (suicide symptoms)	0.83	1.15
Bulimic Investigatory Test Edinburgh (BITE)		
Symptom scale	12.30	6.96
Severity scale	4.48	4.52
Clinical Impairment Assessment (CIA)	27.96	14.09
Eating Attitudes Test (EAT-40)	48	28.52
Eating Disorder Examination Questionnaire (EDE-Q)		
Global score	79.83	36.91
Restraint	18.96	8.60
Eating concern	14.57	7.76
Shape concern	34.04	11.81
Weight concern	18.83	8.79
The Symptom Checklist-90-Revised (SCL-90-R)	138.74	80.81

Note: *M*=mean; *SD*=standard deviation. Higher scores for clinical tests indicate higher levels of impairment.