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Research in Autism Spectrum Disorders

Journal homepage: <http://ees.elsevier.com/RASD/default.asp>

Common and unique impairments in facial-expression recognition in pervasive developmental disorder-not otherwise specified and Asperger's disorder

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ARTICLE INFO

Article history:

Received 14 July 2012

Received in revised form 23 October 2012

Accepted 24 October 2012

Keywords:

Asperger's disorder

Facial expression recognition

Pervasive developmental disorder

Pervasive developmental disorder-not otherwise specified

ABSTRACT

This study was designed to identify specific difficulties and associated features related to the problems with social interaction experienced by individuals with pervasive developmental disorder-not otherwise specified (PDD-NOS) using an emotion-recognition task. We compared individuals with PDD-NOS or Asperger's disorder (ASP) and typically developing individuals in terms of their ability to recognize facial expressions conveying the six basic emotions. Individuals with PDD-NOS and ASP were worse at recognizing fearful faces than were controls. Individuals with PDD-NOS were less accurate in recognizing disgusted faces than were those with ASP. The results suggest that PDD subtypes are characterized by shared and unique impairments in the ability to recognize facial expressions. Furthermore, the ability to recognize fearful but not disgusted expressions was negatively correlated with the severity of social dysfunction in PDD-NOS and ASP. The results suggest that impaired recognition of fearful and disgusted faces may reflect the severity of social dysfunction across PDD subtypes and the specific problems associated with PDD-NOS, respectively. Characteristics associated with different levels of symptom severity in PDD-NOS are discussed in terms of similarities with brain damage and other psychiatric disorders.

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1. Introduction

Pervasive developmental disorder (PDD) is characterized by qualitative impairments in social interaction and communication as well as repetitive and stereotyped behavior. PDD includes autistic disorder (AD), Asperger's disorder (ASP), and pervasive developmental disorder-not otherwise specified (PDD-NOS) (American Psychiatric Association [APA], 2000). However, previous studies have placed too much emphasis on the investigation of AD and ASP (Volkmar & Lord, 1998) even though epidemiological studies have shown that PDD-NOS is the most common disorder of those included in PDD (Baird et al., 2006). Individuals with PDD-NOS do not meet the full criteria for PDD but show severe and pervasive impairments in the skills involved in reciprocal social interactions or verbal and nonverbal communication or engage in stereotyped behavior, interests, and activities (APA, 2000). Although these individuals experience clinically significant problems with social interaction and frequently suffer from secondary problems (de Bruin, Ferdinand,

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Meester, de Nijs, & Verheij, 2007; Gadow, DeVincent, Pomeroy, & Azizian, 2004), the characteristics associated with different levels of PDD-NOS symptom severity remain unknown. Furthermore, under the newly developed criteria of DSM-5, which adopts a unified diagnosis for autism spectrum disorder (ASD), some individuals with PDD-NOS may not be diagnosed with ASD and may not receive appropriate support (Gibbs, Aldridge, Chandler, Witzlsperger, & Smith, 2012; McPartland, Reichow, & Volkmar, 2012). Thus, we need to clarify the characteristics associated with symptom severity in PDD-NOS.

Several recent studies have investigated the severity of symptoms related to impaired social interaction in PDD-NOS using standard diagnostic tools. Walker et al. (2004) demonstrated that individuals with PDD-NOS showed milder autistic symptoms and relatively poor daily living skills. Mandy, Charman, Gilmour, and Skuse (2011) found that individuals with PDD-NOS had impairments in social interaction that were comparable to those associated with other PDD subtypes, but that they exhibited fewer repetitive and stereotyped behaviors. Although these studies provide abundant evidence about the characteristics of PDD-NOS, the question of whether PDD-NOS is just a less severe variant of AD and ASP remains unanswered. Given that individuals with PDD-NOS are likely to have co-morbid psychiatric disorders (de Bruin et al., 2007; Gadow et al., 2004) that relate to impaired social cognition, it is possible that those with this condition have specific intrinsic impairments. This study was designed to identify specific difficulties and associated features related to the problems with social interaction experienced by individuals with PDD-NOS who have no co-morbid psychiatric disorders.

Extensive research on the ability to recognize the emotions depicted on another's face [see Harms, Martin, and Wallace (2010) for a review] has been conducted to elucidate the cause of poor social interaction in PDD because difficulty with the perception and expression of emotions has been suggested as contributing to failure in establishing interpersonal relationships (Hobson, 1993). A number of studies asked participants to select the verbal label that best described the emotion shown in photographs of emotional faces. The same method has also been used with individuals suffering from psychiatric disorders (e.g., Douglas & Porter, 2010; Sprengelmeyer et al., 1996) and brain damage (e.g., Adolphs, Tranel, Damasio, & Damasio, 1994; Calder, Keane, Manes, Antoun, & Young, 2000). These studies revealed some strong correlations between impaired recognition of specific emotions and structural and/or functional abnormalities in specific brain regions such as the amygdala and the insula (e.g., Adolphs et al., 1994; Sprengelmeyer et al., 2011). Several functional MRI studies have shown that these brain regions are involved in social and emotional functions [see Adolphs (2010) and Lamm and Singer (2010) for reviews]. Thus, this method offers a number of advantages to efforts to infer the underlying psychological and neural mechanisms of the clinical manifestations of PDD-NOS.

The extant literature suggests that individuals with AD or ASP experience specific impairments in the ability to recognize fearful facial expressions (Adolphs, Sears, & Piven, 2001; Ashwin, Chapman, Colle, & Baron-Cohen, 2006; Corden, Chilvers, & Skuse, 2008; Howard et al., 2000; Humphreys, Minschew, Leonard, & Behrmann, 2007; Pelphrey et al., 2002; Uono, Sato, & Toichi, 2011). Several studies have also reported that the ability to recognize fearful expressions was negatively correlated with the severity of social and emotional dysfunction in individuals with ASP (Humphreys et al., 2007; Uono et al., 2011) and typically developing individuals (Corden, Critchley, Skuse, & Dolan, 2006). These findings have been viewed as clues to the psychological and neural mechanisms of social dysfunction in PDD because difficulties with the recognition of fearful faces have been linked to damage to the amygdala (Adolphs et al., 1994; Sato et al., 2002), which is involved in various social behaviors [see Baron-Cohen et al. (2000) for a review].

In contrast to AD and ASP, only a few studies have investigated the ability to recognize facial emotions in PDD-NOS (Buitelaar, Van Der Wees, Swaab-Barneveld, & Van Der Gaag, 1999; Kessels, Spee, & Hendriks, 2010; Serra, Jackson, van Geert, & Minderaa, 1998; Uono et al., 2011). Several studies found no impairment in individuals with PDD-NOS (Buitelaar et al., 1999; Serra et al., 1998). However, this may be because these studies did not analyze group differences for each category of emotion. Two recent studies demonstrated impaired emotion recognition in PDD-NOS. Uono et al. (2011) suggested that individuals with ASP and PDD-NOS are worse than typically developing controls at recognizing fearful faces, although participants' demographic characteristics, such as age and IQ, were not sufficiently matched across subtypes. The study conducted by Kessels et al. (2010), in which most participants were diagnosed with PDD-NOS, showed impaired recognition of fearful and disgusted faces. However, it remains unknown whether that result is specific to PDD-NOS because the study did not compare emotion recognition among PDD subtypes. Thus, questions about the pattern of impaired facial expression recognition in individuals with PDD-NOS remain unanswered.

To investigate this issue, we examined the recognition of facial expressions conveying the six basic emotions in individuals with PDD-NOS. Our participants with PDD-NOS had pathologies that were milder than ASP, and they had no co-morbid psychiatric conditions. Thus, we compared those with PDD-NOS, those with ASP, and typically developing individuals with respect to the ability to recognize emotions. Based on the evidence described above, we hypothesized that individuals with PDD-NOS and ASP would exhibit impaired recognition of fearful faces compared with typically developing individuals. Furthermore, we explored whether individuals with PDD-NOS were impaired in recognizing specific emotional facial expressions (e.g., disgust; Kessels et al., 2010). To elucidate the factors that contribute to impaired recognition of facial expressions, we also investigated the relationship between this specific ability and the more general ability to perceive faces. Furthermore, we tested the relationship between impaired facial expression recognition and severity of social dysfunction in individuals with PDD-NOS and ASP. On the basis of previous studies (Corden et al., 2006; Uono et al., 2011), we predicted that the ability to recognize fearful expressions would be negatively correlated with the severity of social dysfunction in individuals with PDD-NOS and ASP.

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