Neonatal and Pediatric Medicine
ISSN: 2572-4983

Highlights on Aberrant Face Processing in Autism Spectrum Disorder and Its Percussions on Management of Autistics

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Received date: July 25, 2017, **Accepted date**: July 29, 2017, **Published date**: August 09, 2017

Abstract

Highlighting the neurological basis of normal face processing and its abnormalities in ASD seems crucial because of its percussions on symptomatology and the management plan of autistic children. Human face processing that has been proven to be compromised in many autistic individuals is pivotal for proper social interactions. Such spontaneous perceptual task in normal children is carried out by face processing areas of the brain as fusiform gyrus, superior temporal sulcus, and amygdala. Behavioral, electrophysiological, and neuroimaging studies showed evidences of dysfunction of such areas in many autistics who often focus on face periphery and cannot interpret that it tells something about a person's state of mind. Very early targeted intervention can stimulate face processing areas of the brain during the early developmental phases of social brain circuitry which in turn will help autistics to pay attention to faces and learn how to understand emotional expressions. Eventually, prevention or at least significant amelioration of both the spectrum and severity of autistic symptomatology might be possible.

Keywords: Autism spectrum disorder (ASD); Face processing; Fusiform gyrus; Superior temporal sulcus; Amygdala; Functional magnetic resonance imaging

Introduction

Autism spectrum disorder (ASD) is a lifelong neurodevelopmental disorder that is characterized by impaired social and communicative abilities as well as restricted, repetitive, stereotyped pattern of behaviors, interests, and activities. in social interactions in autistics are manifested mainly by impairment in eye to eye contact, social reciprocity, and response to emotional cues [1-3].

Face perception is an individual's understanding and interpretation of the face, especially the human face, in conjunction with the related information processing in the brain. In general, it is very important in individual's social interaction but it is a complex perceptual function with extensive involvement of areas in the brain which when damaged can lead to impediment in understanding and interpretation of faces; i.e. prosopagnosia [4].

Highlighting the neurological basis of normal face processing and its abnormalities in ASD seems crucial as aberrant face processing has been claimed to be an important neuro-psychopathological mechanism behind social impairment in autistics with subsequent vital percussions on their management plan [5].

Face processing in normal individuals

Naturally, humans have the ability to read others' facial expressions with out the feelings they convey and the state of mind they Face processing in humans is a cornerstone of most social interactions and orientation to others' people eyes is an innate social programming in humans [6-8].

Neural systems responsible for face processing are present early in life; accordingly its impairment an early dysfunction of such early developed brain circuits. Normal neonates show visual preference for faces and fast face recognition [9-11]. By the age of 6 months, typically developing infants exhibit brain responses, which have been documented by event related potentials (ERPs), to facial expressions such as familiar versus unfamiliar faces or fearful versus unfearful or neutral faces. Such early face processing abilities are vital for interpretation of emotional expressions and sharing attention and interests with others [12-16].

Furthermore, in typically developing infants and children, Positron Emission Tomography (PET) and Functional Magnetic Resonance Imaging (FMRI) revealed activation of the right fusiform gyrus of the occipitotemporal cortex (also known as occipitotemporal gyrus) during perception of upright faces compared to non-facial stimuli, inverted or scrambled faces [5,17-19]. Meanwhile, superior temporal sulcus (STS) has been found to be involved in interpretation of facial movements (eyes and mouth) and understanding the meaning of stories and cartoons involving humans, causality, intentionality, and self-perspective [3,19,20]. On the other hand, amygdala; a set of sub-cortical nuclei and a component of the limbic system, has been found to be engaged in understanding familiar faces or those conveying emotional contents. Amygdala is important in both perceiving others and having oneself emotional behaviors and feelings like anger and fear [21,22].

Social motivation hypothesis in ASD

Behavioral, electrophysiological, and neuroimaging studies showed evidences of dysfunction of face processing areas in autistics who focus on face periphery and cannot interpret that it tells something about a person's state of mind [23-25]. Human face processing that was proved to be compromised in many autistic individuals is crucial for proper social interactions. On the other hand, early experience plays a

crucial role for the normal development of many perceptual and cognitive functions including face perception. Accordingly, aberrant face processing may act as a cause (innate dysfunction of face processing areas of the brain) as well as a consequence of reduced social interest in autistics. Such concept can add to the understanding of the background of one of the main diagnostic features of ASD and in addition, it proposes vital percussions on its management (Figure 1) [26-29].

Figure 1: Diagrammatic illustration of social motivation hypothesis of Autism Spectrum Disorder (ASD).

could provide a very stimulation during the period of early developing social brain circuitry. Activities which are suitable for the developmental stage of infants at risk are highly advisable to be planned with doing all to engage them in. Such strategy could prevent or at least ameliorate the spectrum and severity of autistic symptomatology [14,43].

Impact of social motivation hypothesis on management of ASD

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