



Facial emotion recognition in male antisocial personality disorders with or without adult attention deficit hyperactivity disorder

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Abstract

Objective: We aimed to investigate facial emotion recognition abilities in violent individuals with antisocial personality disorder who have comorbid attention deficient hyperactivity disorder (ADHD) or not.

Method: The photos of happy, surprised, fearful, sad, angry, disgust, and neutral facial expressions and Wender Utah Rating Scale have been performed in all groups.

Results: The mean ages were as follows: in antisocial personality disorder with ADHD 22.0 ± 1.59 , in pure antisocial individuals 21.90 ± 1.80 and in controls 22.97 ± 2.85 ($p > 0.05$). The mean score in Wender Utah Rating Scale was significantly different between groups ($p < 0.001$). The mean accurate responses to each facial emotion between groups were insignificant ($p > 0.05$) excluding disgust faces which was significantly impaired in ASPD + ADHD and pure ASPD groups. Antisocial individuals with attention deficient and hyperactivity had spent significantly more time to each facial emotion than healthy controls ($p < 0.05$) while pure antisocial individual had more time to recognize disgust and neutral faces than healthy controls ($p < 0.05$).

Conclusion: Study of complex social cognitive abilities in adults with ADHD and violent behaviors is lacking. This study is the first, investigating the differences according to social cognition cues in violent individual that revealed no significance within pure antisocial individuals and antisocial individuals with ADHD.

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1. Introduction

As a continuous process, prospective studies in attention deficit hyperactivity disorder (ADHD) have often reported that it is predictive for severe unwanted outcomes in forensic psychiatry [1]. Significantly higher arrest rates as adults [2], more court referrals in late adolescence [3], and association between ADHD in adults and antisocial behaviors [4] have been reported in the literature.

The processing of facial emotion recognition is essential for normal socialization and personal interaction and antisocial behaviors such as aggression may be consequences of failure to be appropriately guided by the social cues of other peoples [5]. Distress related cues, especially fearful and sad expressions have been shown to play an important role in inhibiting antisocial behavior [5]. Thus, facial emotion recognition seems to have an important place in modulating interpersonal behavior. Alongside inattentiveness, impulsivity and hyperactivity in patients with ADHD, failure in recognition of social cues may be considered as an independent risk factor for interpersonal troubles in ADHD [6]. However, the emotion recognition abilities of adult ASPD with ADHD patients with violent behavior are lacking in the literature. Thus, the current study was designed to investigate facial emotion recognition abilities in violent patients with ASPD + ADHD and violent individuals with

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pure antisocial personality disorder (ASPD). In this study, we have three hypothesis: i) there should be more impairment in identifying facial emotions in ASPD + ADHD than in pure ASPD, ii) patients with a history of violent acts should have more misidentification rates of facial emotions than healthy controls, iii) the required reaction time for recognizing facial emotions should be more impaired in ASPD + ADHD than in pure ASPD and both of them should be more impaired than healthy controls.

2. Methods

2.1. Participants

Fifty-five male offenders from the Council of Forensic Medicine and Kasimpasa Military Hospital in Istanbul who were referred by court decision for psychiatric examination were enrolled in the study. The control group consisted of 39 healthy individuals recruited from the community. The local ethics committee approved the study. Upon giving written informed consent for participating in the study, all participants were asked to complete a computer based Facial Emotion Recognition Test and fill out the Wender Utah Rating Scale. The researchers who were in the computer evaluation phase were blind to the clinical diagnoses of the participants. The antisocial personality disorder and attention deficient hyperactivity disorder diagnoses were made according to the Diagnostic and Statistical Manual of Mental Disorders, Text Revised (DSM-IV-TR) criteria. The criminal history and criminal record were obtained by looking into court files and interviewing individuals with (ASPD). Individuals with ASPD were divided into two groups: antisocial personality disorder (ASPD) with ADHD ($n = 34$) and pure ASPD ($n = 21$). The exclusion criteria were i) younger than 18 or older than 65 years old, ii) mentally retarded, iii) visual problems, iii) any chronic medical condition, iv) other axis 1 disorders such as substance dependence, v) current use of psychopharmacologic agents.

2.2. Procedure

For dimensional ADHD measures, the Wender Utah Rating Scale (WURS) was used. WURS [7] is a self-report assessment tool with 61 items, for which adults rate the presence of symptoms of childhood ADHD as ‘not at all or very slight’, ‘mild’, ‘moderate’, ‘quite a bit’, or ‘very much’. Twenty-five of these items are most helpful in separating ADHD subjects from normal controls. A cut-off score of >36 points is 96% sensitive and 96% specific for detecting adult ADHD patients [7]. WURS was translated to Turkish by Oncu et al. [8] and the Turkish form has adequate validity and reliability (Cronbach’s alpha 0.88).

2.2.1. Emotion recognition test

This computer-based test included the photos of four male and four female models (a total of 56 mixed photos) with happy, surprised, fearful, sad, angry, disgusted, and neutral

facial expressions from Ekman and Friesen’s series [9]. These photos were digitized on a computer presentation via an SQL data application in a Visual Basic NET software program developed for presentation on a portable computer (2.4 GHz and 3 MB processor, 3 GB main memory, 15.6 inch LCD screen with 1366×768 pixel resolution). At first, the test had a trial section, which was composed of the first seven photos that included each emotional facial expression (i.e., angry, sad, happy, neutral, fearful, disgusted and surprised) that was presented in the same order for each participant. The rest of the 49 photos were used for the data analyses in the study. In these 49 photos, numbers of happy, sad, surprised, fearful, disgusted, angry, and neutral expressions were equal, overall ensuring that participants did not become familiarized to one specific emotional category.

On-screen, participants saw a photo appear, and directly below photos, seven written choices in boxes for that emotion were seen. When a photo appeared on the screen, participants check the box that corresponds to the emotional expression they believe is being shown in the face on the screen. All participants were tested individually in a quiet room. Instructions were given in the same way for the two groups. No feedback was given regarding the appropriateness of any response.

2.3. Data analyses

All statistical analyses were conducted with the Statistical Package for Social Sciences for Windows (SPSS) version 18.0 (SPSS, Chicago, IL). Demographic information was analyzed through descriptive statistics. Variables of gender, marriage status and education were compared by Chi-square test. To test the distribution of the data, the Kolmogorov Smirnov Test was used. For the analyses of abnormally distributed data the comparisons were performed using the Kruskal Wallis and Mann Whitney U tests. In normally distributed data, one way ANOVA was used and Bonferroni correction was made. Correlation analysis was performed by Pearson and Spearman correlation tests. A p value <0.05 was accepted as statistically significant.

3. Results

The mean ages were as follows: in ASPD with ADHD 22.0 ± 1.59 , in pure ASPD 21.90 ± 1.80 and in controls 22.97 ± 2.85 and there was no significant difference between groups ($F = 2.43$ and $p = 0.093$). There were no significance differences between the three groups according to education level ($X^2 = 14.92$ and $p = 0.063$), marital status ($X^2 = 2.39$ and $p = 0.301$) and types of crimes between ASPD + ADHD and pure ASPD ($X^2 = 0.156$ and $p = 0.989$). The violent acts of the patients are summarized in Table 1.

The mean ADHD score according to the Wender Utah Rating Scale was significantly different within groups ($F = 110.29$ and $p < 0.001$). The mean ADHD score in

Table 1
The features of crimes in violent patients.

Type of violence in patients ¹	ASPD + ADHD n = 34	Pure ASPD n = 21	
• Murder	4	3	$X^2 = 0.156, df = 1, p = 0.989$
• Grievous bodily harm by using weapon and/or instrument	8	5	
• Actual bodily harm	5	3	
• Rape	3	2	
• Robbery, pick pocketing	3	2	
• Sexual assault	2	1	
• Embezzlement, forgery	2	1	
• Multiple violence (≥ 2 types)	7	4	

¹ Chi square test was used.

ASPD + ADHD was 67.11 ± 13.19 points, 31.66 ± 12.51 in the pure ASPD group ($p < 0.001$) and 22.97 ± 2.85 points in healthy controls ($p < 0.001$). In addition, the mean ADHD score was significantly higher in pure ASPD than healthy controls ($p = 0.004$).

The findings according to mean accurate responses to each facial emotion between groups after Bonferroni correction were as follows: for sad faces ($F = 0.315$ and $p = 0.731$), for happy faces ($F = 0.596$ and $p = 0.553$), for surprised faces ($F = 0.703$ and $p = 0.498$), performed with one way ANOVA; for neutral faces ($X^2 = 3.84$ and $p = 0.146$), for fearful faces ($X^2 = 1.22$ and $p = 0.544$), for disgusted faces ($X^2 = 6.77$ and $p = 0.034$) and for angry faces ($X^2 = 1.03$ and $p = 0.597$), performed with Kruskal Wallis. Thus, excluding disgusted faces, the mean accurate responses to each facial emotion between groups were insignificant. With Mann Whitney U test, the mean accurate response to disgusted facial emotion in pure individuals with ASPD was significantly lower than patients with ASPD + ADHD ($p = 0.017$) and healthy controls ($p = 0.034$). In addition, individuals with pure ASPD were significantly more inaccurate than healthy controls in identifying neutral faces ($p = 0.045$) (Table 2).

The mean reaction times to facial emotions while recognizing were as follows: for neutral faces ($F = 8.158$ and $p = 0.001$), for disgusted faces ($F = 12.756$ and $p < 0.001$), for surprised faces ($F = 4.287$ and $p = 0.017$), for sad faces ($F = 3.396$ and $p = 0.038$), for fear faces ($F = 6.008$ and $p = 0.004$), for angry faces ($F = 5.367$ and $p = 0.006$) and for happy faces ($F = 5.746$ and $p = 0.004$).

However, the mean response times to each facial emotion between ASPD + ADHD and pure ASPD were not significantly different. Thus, patients with ASPD + ADHD spent significantly more time for each facial emotion than healthy controls while pure ASPD used significantly more time for recognizing disgusted and neutral faces than healthy controls (Table 3).

While searching for a relation between accuracy rate and ADHD scores according to WURS: the only significance was in the pure ASPD group, and the attention deficiency and hyperactivity scores were negatively correlated with mean accurate recognitions of sad faces ($r = -0.456$ and $p = 0.038$). Nevertheless, while searching for a relation between mean response time and ADHD scores according to WURS: the response time to neutral faces was positively correlated with ADHD scores in patients with ASPD + ADHD ($r = 0.374$ and $p = 0.029$).

4. Discussion

In this study, our first surprising finding was the insignificance according to accurate rates of facial emotion recognition between ASPD + ADHD and pure ASPD, excluding the disgusted facial emotion. Emotional facial expressions have an important role in modulating interpersonal behavior. In the literature, well accepted impairment in processing facial emotions has been reported in antisocial people [5]. In addition, impairment in recognizing facial emotions accurately has also been reported in patients with

Table 2
The mean accurate responses of participants towards emotional expressions.

Accuracy mean \pm SD	Happy*	Sad*	Fear**	Disgust**	Angry**	Surprised*	Neutral**
ASPD + ADHD n = 34	6.9 ± 0.2	4.6 ± 1.5	2.5 ± 1.7	4.6 ± 1.9	4.6 ± 2.0	5.0 ± 2.0	4.7 ± 2.2
Pure ASPD n = 21	6.9 ± 0.3	4.4 ± 1.9	2.4 ± 1.6	3.6 ± 1.9	4.5 ± 1.9	4.9 ± 2.0	4.5 ± 2.0
Control n = 39	6.9 ± 0.5	4.3 ± 1.6	2.8 ± 1.7	4.4 ± 1.8	4.5 ± 1.7	5.4 ± 1.8	5.3 ± 2.0
P ¹	0.935	0.918	0.626	0.017*	0.384	0.961	0.299
P ²	0.528	0.709	0.489	0.411	0.551	0.635	0.367
P ³	0.832	0.957	0.295	0.034*	0.463	0.539	0.045*

P¹: ASPD + ADHD vs pure ASPD; P²: ASPD + ADHD vs controls, P³: pure ASPD vs controls.

* Compared with one way ANOVA, Bonferroni correction was made.

** Compared with Mann Whitney U test.

Table 3
The response time of participants towards emotional expressions.

Response time milliseconds	Happy	Sad	Fear	Disgust	Angry	Surprised	Neutral
ASPD + ADHD n = 34	2.5 ± 0.9	3.5 ± 2.7	3.4 ± 1.2	3.5 ± 1.5	3.4 ± 1.5	3.2 ± 1.7	3.0 ± 1.1
Pure ASPD n = 21	2.3 ± 0.5	3.0 ± 0.7	3.0 ± 0.8	3.0 ± 0.7	3.0 ± 0.7	2.8 ± 0.7	3.1 ± 1.2
Control n = 39	2.0 ± 0.0	2.4 ± 0.7	2.6 ± 0.5	2.4 ± 0.4	2.6 ± 0.6	2.5 ± 0.7	2.3 ± 0.6
P ¹	0.987	0.943	0.586	0.212	0.529	0.452	0.951
P ²	0.004**	0.013*	0.003**	0.001**	0.005**	0.013*	0.002*
P ³	0.140	0.681	0.303	0.014*	0.325	0.890	0.004*

Compared with one way ANOVA, Bonferroni correction was made; P¹: ASPD + ADHD vs pure ASPD; P²: ASPD + ADHD vs controls, P³: pure ASPD vs controls.

* p < 0.05.

** p < 0.01.

violent or non-violent schizophrenia [10], first episode schizophrenia or ADHD [11] and in adults with ADHD [12].

In a meta-analysis study, a link between antisocial behavior and misidentification of fearful faces has consistently been found, while impairment in recognizing sad and surprised faces has also been mentioned, while no impairment has been found for happy, disgusted or anger faces [5]. In the literature, there are few studies among adults with ADHD on facial emotion recognition abilities. Historically, the impairment in facial emotion recognition has been thought to be present in children with ADHD while this impairment has been accepted to wane in adulthood [13]. However, adult ADHD studies do not support such a proposal and the most consistent finding in adults with ADHD is a deficiency in recognizing sad, fear and anger faces [6,14]. The amygdala has an important role in recognizing fear and sad emotions [15], which has also been shown to be involved in antisocial behaviors [5]. In the current study, although we could not find an inability to recognize fear and sad facial emotions in ASPD + ADHD and pure ASPD compared to healthy controls, we have shown an impairment in recognizing disgusted facial emotion in both groups. The sensations of taste and odor play a crucial role in experiencing disgust and the insula has been found to be activated by a broad range of disgust related stimuli, as disgusted facial emotions [16]. Furthermore, there is evidence that the anterior insula has a strong connection with the amygdala [17,18] and is enrolled in emotional processing and empathy [19]. Previous studies demonstrated abnormal activation of the anterior insula during empathy or emotional processing tasks in individuals with antisocial behavior [20] and involvement of the insula in modulating attention and inhibitory capacity in adolescents with ADHD [21]. In the literature on the relation between behavior and insula, cognitive and attentional processes are proposed to be located in the anterior parts while emotional aspects are suggested to be located in the inferior parts of the insula [22].

In antisocial behavior and emotion studies, the amygdala and wide brain regions related to the amygdala, such as the ventromedial prefrontal cortex [23] and thalamus and superior colliculus [24], were both implicated in antisocial behavior and impaired affect recognition. Nevertheless, to

date, a study of which neurocognitive mechanisms are involved in adults with ADHD is lacking [6]. However, studies in childhood ADHD have revealed wide involvement of brain regions such as the ventromedial prefrontal cortex and anterior cingulate cortex [25], orbitofrontal cortex and ventral striatum [26], resulting in disinhibition, impulsivity and antisocial behavior, which are similar to the above-mentioned regions in people with ASPD. Thus, the positive finding of the current study might be due to dysfunction of similar brain regions in both patients with ASPD + ADHD and pure ASPD. In the study of Miller et al. [12], slightly more errors in auditory recognition tasks than visual information tests in adults with ADHD were detected. Thus, in our study the comparison of vocal and facial emotion recognition in patients with ASPD + ADHD and pure ADHD would be more informative. In addition, just opposite to our hypothesis, more impairment in identifying facial emotions is not detected in patients with ASPD + ADHD compared to pure ASPD. The ADHD adults with impulsivity and hyperactivity dominance in childhood are supposed to be frequently engaged in social relationships too early, and have learned how to compensate for their disadvantages in social interactions by attending more carefully to cues from other individuals that support the continuity trait of child and adulthood ADHD [12].

In the current study, for the first time we have shown that patients with pure ASPD have more impairment in recognizing neutral facial emotions. Neutral facial emotions have usually been used in the literature as a comparator of other facial emotions in individuals with antisocial behaviors [27,28]. Thus, we could not interpret this finding according to the literature. However, we speculate that individuals with pure ASPD may be more prone to aberrant behavior while having difficulties in recognizing even neutral facial emotions.

In the current study, although the response time for facial emotion recognition between ASPD + ADHD and pure ASPD was not significantly different for each emotion, the patients with ASPD + ADHD required more time to recognize all facial emotions than healthy controls. Also, pure ASPD patients spent more time identifying disgusted and neutral faces than healthy controls. In addition, there was

a positive correlation between response time to neutral faces and ADHD scores in patients with ASPD + ADHD. Therefore, we suggest that the more the pathology, the more time that is required to recognize facial emotions as a compensatory mechanism.

In the current study we have some important limitations. First, the relatively small sample size should be kept in mind while interpreting our findings. Dividing patients with ASPD + ADHD to inattentive, impulsive and combined types would be more explanatory. Lack of psychopathy scores as a psychopathy check list or impulsivity scales would also have been important in this study.

In conclusion, studies of complex social cognitive abilities in adults with ADHD are lacking. This study is the first one investigating differences in social cognition cues between ASPD + ADHD and pure ASPD who had violent acts. Thus, further studies are needed to investigate the relation between violent acts and impulsivity, hyperactivity, inattentiveness or psychopathy in light of the social cueing literature.

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