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GENERALIZED AND SPECIFIC EMOTION IMPAIRMENTS AS POTENTIAL MARKERS OF SEVERITY IN OBSESSIVE-COMPULSIVE DISORDER: A PRELIMINARY STUDY USING FACIAL ACTION CODING SYSTEM (FACS)

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SUMMARY

Background: *The role of emotional deficits in the poor outcomes of patients with Obsessive-Compulsive Disorder (OCD) has been emphasized. Generalized and specific emotional abnormalities have been reported, often related to OCD severity and functional disabilities. The objective of the present study was to assess the abilities of experiencing and displaying emotions in OCD patients in response to specific stimuli in relation with the severity of their clinical condition.*

Subjects and methods: *Thirty-six individuals participated in the study: 10 OCD patients with severe symptoms, 11 with mild-moderate symptoms, and 15 healthy controls. All participants watched emotion-eliciting video clips while their facial activity was videotaped. The congruent/incongruent feeling of emotions and the facial expression in reaction to emotions were evaluated.*

Results: *The two subgroups of OCD patients presented similarly incongruent emotive feelings and facial expressions (significantly worse than healthy participants). Moreover, OCD patients with severe symptoms expressed the emotion of happiness and disgust significantly less appropriately than OCD patients with mild-moderate symptoms.*

Conclusions: *The present data support the hypothesis that impaired emotional processing may: (i) represent a potential contributor to poor outcome in OCD; (ii) constitute a warning sign for clinicians to establish a more comprehensive protocol for more severe cases; (iii) influence therapeutic strategies used to treat this disorder.*

Key words: *Obsessive-Compulsive Disorder – OCD - emotion impairment - emotion recognition - emotion expression - FACS*

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INTRODUCTION

Obsessive-compulsive disorder (OCD) is a chronic disorder, currently recognized as one of the 10 most disabling illnesses by the World Health Organization (WHO) (Nolen 2005). OCD is associated with high levels of personal distress (Huppert et al. 2009), poor quality of life (Fontenelle et al. 2009), with the domain of 'social relationships' being more affected in patients with OCD than in patients with any other mental or physical illness (Subramaniam et al. 2013), persistent impairment in work functioning (Hollander et al. 2010), increased use of health care services (Bobes et al. 2001) and high economic and social burden placed on caregivers (Steketee et al. 1997). Despite the existence of effective therapeutic options for OCD, up to 40-60% of patients do not achieve or do not maintain remission to standard recommended treatments (Pallanti & Quercioli 2006, Piccinelli et al. 1995, Pigott et al. 1999, Jenike & Rauch 1994). Therefore, the relief of these patients' suffering with the available treatments remains a clinical challenge and a theoretical puzzle.

A growing body of literature found an impairment of emotional processing in OCD patients, as well as in other psychiatric disorders such as alcoholism (Kornreich et al. 2001, Martinotti et al. 2009), anorexia nervosa (Zonnevijlle-Bendek et al. 2002), bipolar disorder (Ketter & Lembke 2002, Bersani et al. 2013), social phobia (Simonian et al. 2001), major depression (Rubinow & Post 1992) and schizophrenia (Kohler et al. 2008, Simons et al. 2010). The emotional deficit most frequently observed in OCD patients was the reduction in the ability to recognize disgust from facial expressions (Daros et al. 2014, Sprengelmeyer et al. 1997, Corcoran et al. 2008, Lochner et al. 2012, Rector et al. 2012); this deficit has been show to correlate with the maintenance of OCD symptomatology (Kang et al. 2012), its increased severity (Grisham et al. 2010) and patients' functional impairment (Lochner et al. 2012, Berle & Phillips 2006, Olatunji et al. 2005). However Daros et al. (2014) observed in a recent meta-analysis that, compared to control subjects, OCD patients reported an overall impairment in emotion recognition involving all the six basic emotions (happy,

angry, sad, disgust, fear, and surprise) and especially the negative emotions.

Given the above, it can be speculated that the assessment of emotion processing, and in particular of disgust, may give some indications on patients' psychopathological severity and that tailored treatments targeting emotions' processing deficits may be helpful in patients with severe symptoms and poor pharmacological response.

To the best of our knowledge, only a few studies have investigated the expression of emotions in OCD patients. Mergl et al. (2003) found that the execution of adequate facial reactions to humor was abnormally slow in OCD patients and correlated with the severity of symptoms; Bersani et al. (2012) reported that patients with schizophrenia and OCD presented similarly incongruent emotive feelings and facial expressions significantly worse than healthy participants. However, no studies directly investigated facial expression abilities in OCD patients with different disease severity and matched controls.

Therefore, the objective of the present study was to assess the abilities of experiencing and displaying emotions in OCD patients in response to specific stimuli in relation with the severity of their clinical condition.

SUBJECTS AND METHODS

Participants

The sample consisted of 21 outpatients consecutively recruited at the A. Fiorini University Hospital of Terracina, La Sapienza University of Rome, and 15 healthy controls (HCs). HCs were recruited among Hospital and University staff. After complete description of the study to the participants, written informed consent according to general recommendations in the Declaration of Helsinki was obtained. The local ethics committee approved the study.

Patients underwent a structured clinical interview according to the Structured Clinical Interview for DSM IV Disorders (SCID-I). Patients were included if they had a diagnosis of OCD, no other comorbid psychiatric conditions of clinical significance and ranged in age from 18 to 65 years old. Patients with significant neurological diseases, other Axis 1 diagnoses, a history of abuse of alcohol or other drugs of abuse or on treatment with typical antipsychotics were excluded from the study.

Clinical assessment

OCD outpatients were assessed through the Yale-Brown Obsessive Compulsive Scale (Y-BOCS). Y-BOCS is a clinician-rated, 10-item scale, each item rated from 0 (no symptoms) to 4 (extreme symptoms), yielding a total possible score range from 0 to 40 (Goodman et al. 1989). The scale includes questions about the amount of time the patient spends on obsessions, how much impairment or distress they experience, and how much resistance and control they have over these thoughts. The same types of questions are asked about compulsions (e.g., time spent, interference, etc.) as well.

Patients were divided into two groups in relation with categorical classifications of the Y-BOCS (Steketee 1999, Federici et al. 2010) reflecting OCD severity: severe OCD patients (S-OCD) (n=10; Y-BOCS ≥24) and mild-moderate OCD patients (M-OCD) (n=11; Y-BOCS ≤23). They were matched with a control group (n=15) comparable in age, gender and years of formal education. More details on socio-demographic and clinical characteristics of the participants are given in Table 1.

Table 1. Socio-demographic and treatment-related data on the study participants

	Severe OCD	Mild-Moderate OCD	Healthy Controls	P-value
Number of subjects	10	11	15	
Mean age (years)	40.61±6.12	37.77±8.21	41.71±12.53	0.81
Males - N (%)	5 (50)	5 (45)	7 (46.7)	0.97
Education (years)	12.61±4.27	13.52±4.17	13.02±4.25	0.83
Mean Y-BOCS score	26.20±2.65	16.00±3.52	-	<0.01
Age of onset	15.30±5.39	23.34±13.13	-	0.05
Disease duration (number of years)	25.31±7.81	14.43±5.57	-	<0.01
Pharmacological treatment				
Mood stabilizers (Valproate) – N (%)	6 (60)	3 (27.3)	-	0.14
SSRIs - N (%)	9 (90)	10 (90.9)	-	0.74
Atypical (Aripiprazole) - N (%)	4 (40)	0 (0)	-	0.04
Benzodiazepines - N (%)	7 (70)	7 (63.6)	-	0.56
TCAs (clomipramine) - N (%)	6 (60)	1 (9.1)	-	0.21

TCAs: Tricyclic antidepressants (TCAs); SSRIs: selective serotonin reuptake inhibitors

Table 2. Action units (AUs) in the Facial Action Coding System (FACS)

AU number	FACS name	Muscular basis
1	Inner Brown Raiser	Frontalis, Pars Medialis
2	Outer Brown Raiser	Frontalis, Pars Lateralis
4	Brown Lowerer	Depressor Glabellae; Depressor Supercilli; Corrugator
5	Upper Lid Raiser	Levator Palpebrae Superioris
6	Cheek Raiser	Orbicularis Oculi, Pars Orbitalis
7	Lid Tightener	Orbicularis Oculi, Pars Palpebralis
8	Lips Toward Each Other	Orbicularis Oris
9	Nose Wrinkler	Levator Labii Superioris, Alaeque Nasi
10	Upper Lip Raiser	Levator Labii Superioris, Caput Infraorbitalis
11	Nasolabial Furrow Deepener	Zygomatic Minor
12	Lip Corner Puller	Zygomatic Major
13	Cheek Puffer	Caninus
14	Dimpler	Buccinator
15	Lip Corner Depressor	Triangularis
16	Lower Lip Depressor	Depressor Labii
17	Chin Raiser	Mentalis
18	Lip Puckerer	Incisivii Labii Superioris; Incisivii Labii Inferioris
20	Lip Stretcher	Risorius
22	Lip Funneler	Orbicularis Oris
23	Lip Tightner	Orbicularis Oris
24	Lip Pressor	Orbicularis Oris
25	Lips Part	Depressor Labii, or Relaxation of Mentalis or Orbicularis Oris
26	Jaw Drop	Masetter; Temporal and Internal Pterygoid Relaxed
27	Mouth Stretch	Pterygoids; Digastric
28	Lip Suck	Orbicularis Oris
38	Nostril Dilator	Nasalis, Pars Alaris
39	Nostril Compressor	Nasalis, Pars Transversa and Depressor Septi Nasi
41	Lid Droop	Relaxation of Levator Palpebrare Superioris
42	Slit	Orbicularis Oculi
43	Eyes Closed	Relaxation of Levator Palpebrae Superioris
44	Squint	Orbicularis Oculi, Pars Palpebralis
45	Blink	Relaxation of Levator Palpebrae and Contraction of Orbicularis Oculi, Pars Palpebralis
46	Wink	Orbicularis Oculi

Table 3. Expected action units for each emotion

Emotion	Prototypes	Major Variants
Surprise	1+2+5B+26 / 1+2+5B+27	1+2+5B / 1+2+26 / 1+2+27 / 5B+26 / 5B+27
Fear	1+2+4+5*+20*+25, 26, or 27 / 1+2+4+5*+25, 26, or 27	1+2+4+5*+L or R20*+25,26, or 27 / 1+2+4+5* / 1+2+5Z, with or without 25,26,27 / 5*+20* with or without 25,26,27
Happy	6+12*, 12C/D	
Disgust	9 / 9+16+15/ 26 / 9+17	
Anger	4+5*+7+10*+22+23+25,26 / 4+5*+7+l0*+23+25,26 / 4+5*+7+23+25, 26 / 4+5*+7+17+23 / 4+5*+7+17+24 / 4+5*+7+23 / 4+5*+7+24	Any of the prototypes without any one of the following: AUs: 4, 5, 7, or 10.
Sadness	1+4+11+15B / 1+4+15* / 6+15*	1+4+11 / 1+4+15B / 1+4+15B+17 / 11+15B / 11+17

AU - action units; R - actions only on the right side of the face; L - actions only on the left side of the face; *In this combination the AU may be at any intensity level; A–E represent the intensity of the action: A- Trace; B - Slight; C - Marked or Pronounced; D - Severe or Extreme; E – Maximum

Table 4. Video clips used to elicit emotions

Video	Description	Emotion	Length of film clip (minutes:second)
1: Color bars	Color bars	Neutrality	0:08
2: When Harry met Sally	Discussion of orgasm in café	Happiness	2:35
3: The silence of the lambs	Basement chase scene	Fear	3:29
4: Sea of love	Person startled by pigeons	Surprise	0:09
5: Cry freedom	Police abuses protesters	Anger	2:36
6: The Champ	Boy cries at father's death	Sadness	2:51
7: Pink Flamingos	Person eat dog faeces	Disgust	0:30

Emotional assessment: Facial Action Coding System and video clips

The Facial Action Coding System (FACS) by Ekman and Friesen (1978) is one of the most widely used instruments for the analysis of facial expression. It is based on an anatomical analysis of facial action through the codification of facial expression in 44 "action units" (AUs; Table 2). AUs are anatomically defined; they represent the basic repertory of human facial expressions (Polli et al. 2012). Using the FACS, the variety of facial movements can be observed objectively. The FACS investigator's guide (Ekman et al. 1978) codes the exact combinations of AUs that should be observed in response to each emotional stimulus (Table 3).

The use of video clips to elicit specific emotions has a long history in clinical psychology and psychiatry (Philippot 1993); Gross and Levenson (1995) systematized this issue selecting and validating 16 films that successfully elicited amusement, anger, contentment, disgust, sadness, surprise, fear, and a neutral state. Among them, 7 were selected for this research (all in Italian); more details are given in Table 4.

Study protocol

After the clinical assessment, all patients watched the video clips designed to elicit significant and specific emotions. The facial expression of each patient in response to the vision of the films was video recorded. These video clips were watched by the three groups of subjects in the same order, according to the protocol established by Gross and Levenson (1995) and according to the protocol of previous studies by our research team (Bersani et al. 2012, Bersani et al. 2013): video 1= neutral; video 2= amusement; video 3= fear; video 4= surprise; video 5= anger; video 6= sadness; video 7= disgust.

After each single video clip, patients were asked to fill out a questionnaire to indicate what emotion they experienced in relation to the video (Bersani et al. 2012). Each response to the questionnaire was then scored in relation to the expected emotion. A score of 1 was given for each emotional report concordant with the expected emotion and a score of 0 was given if the patient reported to not have felt any emotion or to have felt an emotion different from that expected. Scores could range between a minimum of 0 and a maximum of 7.

At the end of the film session, the mimic reactions to the video clips were analyzed and coded following the indications of the FACS investigator's guide (Ekman et al. 1978). The same three examiners (EP, GV, DL) evaluated all video registrations. The three examiners previously attended a specific workshop organized by the University of Trieste. For the scoring it was considered the specific expected emotion associated to the video and the combination of AUs observed in response. Since each video was evocative of only one specific emotion, specific combinations of AUs were expected in relation to each video (Table 3). If one of the expected combinations of AUs occurred, the examiners assigned the score 1; if the expected combinations did not occur the examiners assigned the score 0 (this scoring was repeated for each movie clip). Scores could range between a minimum of 0 and a maximum of 7.

Statistical Analysis

The data were analyzed using SPSS software version 20 (IBM Corporation, Armonk, NY, USA). One-way univariate analysis of variance (ANOVA) and Chi-squared test were used to compare socio-demographic data of participants. In addition to descriptive statistics, one-way univariate ANOVA was performed to compare the mean scores of participants divided into sub-groups. As the diagnosis factor had more than two levels, post-hoc tests were calculated using the Bonferroni test. Chi-squared and Fisher's exact test were used to compare the right or wrong facial expression in reaction to emotional stimuli of the two sub-groups of patients.

RESULTS

Post film questionnaire

One-way ANOVA determined statistically significant differences between group means ($F2=11.41$, $P<0.01$). Mean score ± standard deviation of the report of concordant responses was 4.40±1.34 for S-OCD patients,

5.27±1.55 for M-OCD patients and 6.60±0.40 for healthy controls. The comparison between groups with the post-hoc Bonferroni test revealed that healthy controls had significantly higher scores than both S-OCD (difference of means =2.20; P<0.01) and M-OCD (difference of means =1.32; P=0.02) patients. There were not significant differences between S-OCD and M-OCD patients (difference of means =-0.87; P=0.34; Figure 1).

Facial expression in reaction to emotional stimuli in OCD subgroups and healthy controls

One-way ANOVA determined statistically significant differences between group means (F2=32.47, P<0.01). Mean FACS score was 2.70±1.41 for S-OCD patients, 3.91±0.94 for M-OCD patients, and 5.93±0.72 for healthy controls. The comparison between groups with the post-hoc Bonferroni test revealed that the FACS score of S-OCD patients was significantly lower than M-OCD patients (difference of means =−1.20; P=0.03) and healthy controls (difference of means =-3.23; P<0.01). M-OCD patients and healthy controls also had significantly different scores (different of means =-2.02; P<0.01; Figure 2).

Facial expression in reaction to specific emotional stimuli in OCD subgroups

Significant differences have been recorded in the congruent expression of the emotions of disgust and happiness in the two OCD subgroups of patients: In comparison with M-OCD patients with S-OCD showed significantly poorer performances (Table 5). No significant differences were observed in the other emotions.

Table 5. Number of Severe (S) and Mild-Moderate (M) OCD patients who expressed congruent or incongruent facial expression in response to video clips stimuli

	Expressed facial emotion (assessed through the Facial Action Coding System)											
	Fear			Sadness			Happiness			Surprise		
	S	M	P	S	M	P	S	M	P	S	M	P
Video 1 (eliciting neutrality)	0	0	-	0	0	-	0	0	-	0	0	-
Video 2 (eliciting happiness)	0	0	-	0	0	-	2	9	*0.01**	0	0	-
Video 3 (eliciting fear)	1	3	0.31	0	0	-	0	0	-	2	1	0.50
Video 4 (eliciting surprise)	1	1	0.94	0	0	-	0	0	-	2	3	0.69
Video 5 (eliciting anger)	0	0	-	1	1	0.94	0	0	-	0	0	-
Video 6 (eliciting sadness)	0	0	-	5	3	0.28	0	0	-	0	0	-
Video 7 (eliciting disgust)	0	0	-	1	1	0.94	0	0	-	0	0	

	Expressed facial emotion (assessed through the Facial Action Coding System)								
	Anger			Disgust			Neutrality		
	S	M	P	S	M	P	S	M	P
Video 1 (eliciting neutrality)	0	0	-	0	0	-	10	11	-
Video 2 (eliciting happiness)	0	0	-	6	1	*0.01**	2	1	0.50
Video 3 (eliciting fear)	0	0	-	1	0	0.28	6	7	0.86
Video 4 (eliciting surprise)	0	0	-	0	0	-	7	7	0.75
Video 5 (eliciting anger)	3	6	0.25	2	0	0.11	4	4	0.86
Video 6 (eliciting sadness)	1	3	0.31	0	1	0.32	4	4	0.86
Video 7 (eliciting disgust)	0	0	-	3	8	*0.05**	6	2	*0.05**

*P≤0.05

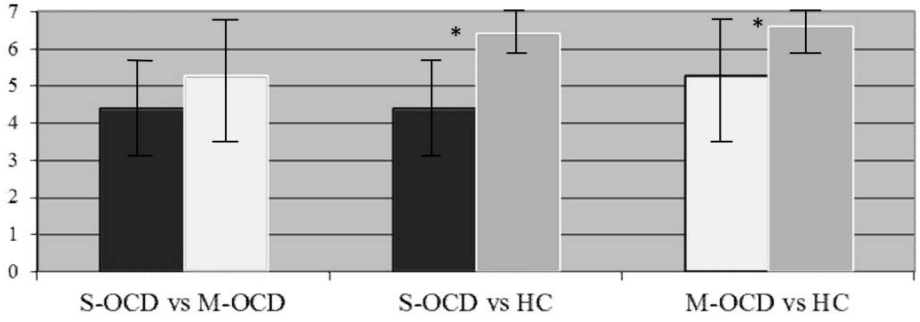

Figure 1. Mean number of concordant responses in Severe OCD subgroup (S-OCD), Mild-Moderate OCD subgroup (M-OCD) and healthy controls (HC) (*P<0.05)

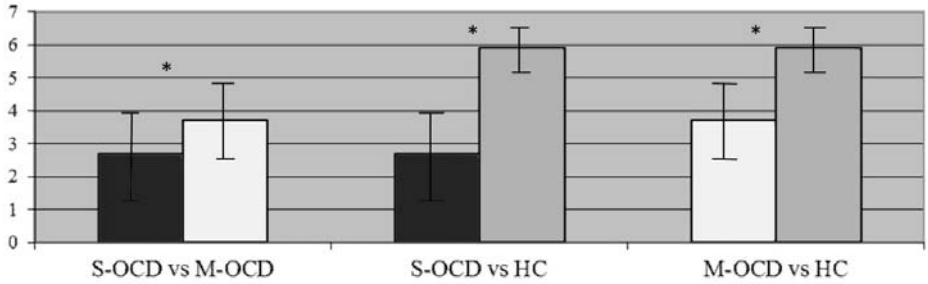

Figure 2. Mean FACS score in Severe OCD subgroup (S-OCD), Mild-Moderate OCD subgroup (M-OCD) and healthy controls (HC) (*P<0.05)

DISCUSSION

The results of the study support previous findings (Mergl et al. 2003) of an overall impaired emotional processing in OCD patients, not only in emotions experience but also in emotions expression. Splitting the OCD sample according to symptoms severity it results that patients with more severe symptoms performed significantly worse than the others, confirming previous findings indicating that the emotional impairment may correlate with the severity of the disorder. Since accurate emotion processing is a critical element of humans' social structure (Ekman 1992), such abnormalities may relevantly affect patients' interaction abilities and their social functioning.

Severe and mild-moderate patients significantly differed in the processing of disgust, with severe patients showing significantly poorer performances. Recent studies suggested a positive correlation between an impaired disgust processing and the maintenance of OCD symptomatology (Kang et al. 2012), its increased severity(Grisham et al. 2010) and increased functional impairment (Corcoran et al. 2008, Berle & Phillips 2006, Olatunji et al. 2005); our findings support the idea that the specific impairment of disgust may be considered a psychopathological dimension associated with the severity of OCD symptomatology.

Disgust differs from other negative emotions in that it has evolved from a basic evolutionary sense in avoiding distaste and contamination to one that includes higher order constructs such as moral reasoning and interpersonal rejection (Rozin & Fallon 1987). Interest in the potential role of this emotion in OCD arises from several lines of reasoning. First is the suggestion that appraisals leading to disgust responses may often involve contamination concerns, so that disgust might therefore play a role in contamination obsessions and washing compulsions in OCD (Berle & Phillips 2006). Second is the idea that there is impaired learning of disgust recognition among individuals with OCD. In this context, cognitive appraisals that derive from an excessive experience of disgust may increase perceptions of rejection towards objects and situational triggers and thereby increase anxiety to cues that do not normally elicit anxiety (Mataix-Cols et al. 2008). Third is the hypothesis that similar brain regions might be associated with both disgust responses and OCD pathology (Husted et al. 2006); in particular, disgust processing seems to be mediated by the hyperactivation of anterior insula (Fusar-Poli et al. 2009), that is supposed to be involved in the emotional response to potentially distressing cognitive stimuli, interoceptive sensory stimuli, and body sensations (Reiman et al. 1997). According to this view, individuals with OCD fail to develop accurate connections between disgust-related cues and evocations of disgust, given the fact that the chronic course of the disorder, often arising in childhood or even adolescence, may compromise neural pathways involving the insular cortex and the cortico–striatal–thalamic–cortical circuitry (Husted et al. 2006).

Abnormalities in disgust processing are not exclusively found in OCD patients; in fact, a growing body of literature has reported similar disgust-related deficits in SCZ (Trémeau et al. 2005, Wylie & Tregellas 2010), both in its prodromal phase and chronic course (Comparelli et al. 2014). OCD and SCZ share relevant clinical manifestations suggesting a possible common neurodevelopmental origin: they have juvenile onset and chronic course (Guz & Aygun 2004); neurological soft signs are present in both clinical conditions (Thomas & Tharyan 2011); obsessive and compulsive symptoms are clinically important phenomena in SCZ patients (Fabisch et al. 2001); OCD patients often experience psychosis (Attademo et al. 2012). Given the above, the common alteration of the disgust processing in OCD and SCZ may represent an additional evidence of common neurodevelopmental substrates of the two disorders.

A further evidence of the inappropriate disgust processing in OCD patients is provided by the facial expressions displayed in response to the video that was supposed to elicit happiness (table 5); S-OCD patients showed an expression of disgust in response to happiness stimuli significantly more that M-OCD patients. At first, this result may be considered as an impairment of happiness processing, possibly associated with the co-occurrence of negative mood states (Falkenberg et al. 2012). Secondly, the finding might be

related to specific video clip used to elicit happiness: the discussion of orgasm in a café of the film "When Harry met Sally" may collide with OCD patients' strict moral code and concern for preventing harm that goes beyond that observed in the normal population (Whitton et al. 2014). It can be hypothesized that this video clip, selected in the studies of Gross and Levenson (1995), could trigger beliefs of inflated responsibility (e.g. "enjoying these images means that I am a bad person") and subsequent emotion of 'moral' disgust (Mancini et al. 2004, Salkovkis et al. 2000, Ottaviani et al. 2013).

How individuals with OCD experience disgust in relation to objects and cues remains a potentially important, state-dependent (Daros et al. 2014), vulnerability factor associated with the disorder and its severity. From a clinical point of view, Rector et al. (2012) provided preliminary evidence for the potential malleability of disgust recognition abnormalities in OCD through Cognitive-Behavior Therapy (CBT) as a result of acute symptom reduction and/or normalization of cognitive patterns associated with disgust responses (Rector et al. 2012). It can be hypothesized that CBT successfully targets the neurobiological substrates involved in disgust recognition through a normalization of hyperactivities within the orbitofrontal cortex, caudate nucleus, and insular cortex (Saxena et al. 2002, Lázaro et al. 2008) and, for this reason, in severe OCD should be regularly associated to recommended pharmacological interventions.

The present study has several limitations. The small number of participants is a major limitation of the research. OCD is a heterogeneous disorder with different symptom subtypes potentially associated with different cognitive and emotional correlates; it is thus possible that the different subtypes of the disorder (i.e. contamination/cleaning, doubt about harm/checking, symmetry/ordering, and unacceptable thoughts/mental rituals) have different impacts on the responsiveness to specific emotional stimuli. In the present study, the sample size did not allow to investigate possible correlations between symptom presentation and emotional processing. Moreover, the coders were not blinded about the status of patients.

The choice to reduce the power of FACS to a binary number (expression prototype present or absent) makes it a less sensitive measure as different degrees of more refined and subtle facial movements could not be evaluated. However, this step was deemed necessary as it reduced the possibility of codification bias.

Finally, psychotropic medications and psychotherapies may influence emotion recognition and expression accuracy. In particular, a reduction in emotional sensitivity as well as a sense of numbing or blunting of the emotions is a described effect of the class of antidepressants. Future research should involve patients without a history of psychological or pharmacological interventions.

CONCLUSIONS

In conclusion, our data support the hypothesis that impaired emotional processing may: (i) represent a potential contributor to poor outcome in OCD; (ii) constitute a warning sign for clinicians to establish a more comprehensive protocol for more severe cases; (iii) influence therapeutic strategies used to treat this disorder.

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Conflict of interest : None to declare.

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