Schizophrenia Research 171 (2016) 35–41

Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

Obsessive–compulsive symptoms interact with disorganization in influencing social functioning in schizophrenia

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ARTICLE INFO

Article history:
Received 23 September 2015
Received in revised form 27 November 2015
Accepted 1 January 2016
Available online 20 January 2016

Keywords:
Schizophrenia
Obsessive–compulsive disorder
Disorganization, functioning
Dimension

ABSTRACT

Objective: Recent research has suggested a dual impact of obsessive–compulsive dimension on functioning in schizophrenia with a gradual transition from an improving to a worsening effect depending on obsessive–compulsive symptoms (OCS) severity (from mild to moderate–severe). Aim of the present study was to investigate whether this varying effect of OCS on functioning might be mediated or moderated by schizophrenia symptom dimensions or occur independently.

Method: Seventy-five patients affected by schizophrenia were administered the Structured Clinical Interview for DSM-IV Disorders, the Positive and Negative Syndrome Scale, the Yale-Brown Obsessive–Compulsive Scale and the Social and Occupational Functioning Assessment.

The sample was divided into two groups according to the severity of OCS (absent/mild and moderate/high OCS group).

Results: In both groups, the effect of OCS on functioning was not mediated by their effect on positive, negative or disorganization symptoms. Conversely, a significant interaction between OCS and disorganization dimension was found: the dual effect of OCS on functioning occurred only among patients with low disorganization symptoms while it was no more apparent at high levels of disorganization.

Conclusion: Data suggest that in patients with schizophrenia, functioning at least in part depends on the interaction between disorganization and OCS.

1. Introduction

A growing literature suggests that obsessive–compulsive symptoms (OCS) would represent a distinct and clinically relevant dimension in schizophrenia (Poyurovsky et al., 2012), since the occurrence of OCS has been associated with worse clinical outcome and greater disability (de Haan et al., 2013a, 2013b; Lysaker and Whitney, 2009; Tiryaki and Ozkorumak, 2010; Üçok et al., 2014). However, recent studies questioned the assumption of an adverse effect of OCS on functioning in schizophrenia. For instance, as compared to full-blown obsessive–compulsive disorder (OCD), mild OCS (i.e., symptoms below the diagnostic threshold for OCD) have been found to improve functioning (de Haan et al., 2013a). Furthermore, Tonna et al. (2015a) demonstrated a gradual transition from a positive effect to an adverse impact on functioning depending on the OCS severity (from mild to moderate–severe). Interestingly, these results are consistent with the early hypothesis that OCS (at a mild level) might be considered a compensatory attempt to mitigate the course of schizophrenia (Jahrreiß, 1926; Rosen, 1957; Stengel, 1945).

The complex relationship between OCS and social functioning is not yet clarified: specifically, research has not yet evaluated whether OCS influence functioning independently from the effect exerted by positive, negative and disorganization symptoms of schizophrenia or whether OCS and schizophrenic symptoms interact with each-others to affect functioning.

Three major hypotheses may be advanced: 1) OCS might influence functioning as a result of the association with other schizophrenia symptoms; that is, the effect of OCS on functioning would be mediated by schizophrenia symptom dimensions; 2) OC and schizophrenia symptom dimensions are independent from each-others; nonetheless they might interact in affecting social functioning; 3) OC and schizophrenia symptom dimensions are not associated and do not interact with each-others in impacting functioning.

To our knowledge, no study has yet investigated the interplay between OCS and schizophrenia symptom dimensions with respect to global functioning, even though the association between OCS and symptoms of schizophrenia has been extensively investigated. Since neither a consistent pattern of association (de Haan et al., 2013a, 2013b; Poyurovsky et al., 2012) nor a specific clinical profile (Devi

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http://dx.doi.org/10.1016/j.schres.2016.01.002
0920-9964/

et al., 2015) have been found, it has been suggested that OC dimension would be independent from other symptom dimensions.

Further, most studies assessing the pattern of association between OCS and schizophrenia symptoms used a categorical approach to OCS (patients with OCD vs patients with sub-threshold OCS). In recent years a dimensional approach to schizophrenia has been strongly emphasized; indeed, the heterogeneity in clinical expression and in the course of the disease may be better explained by a dimensional model (Insel, 2010; Tandon et al., 2009). According to this view, schizophrenia represents a "complex" syndrome constituted by relatively distinct psychopathological dimensions, which may interact with each-others in affecting the levels of functionality (Keshavan et al., 2008; Tandon et al., 2009).

Therefore, the present study aimed to elucidate the interplay between OCS and positive, negative and disorganization symptoms of schizophrenia in affecting psychosocial functioning, using a dimensional approach. We investigated whether the previously described varying effect of OCS on functioning (i.e., a positive effect at mild levels of OCS, and an adverse effect at moderate/high levels of OCS (Tonna et al., 2015a) occurs independently from that of schizophrenic symptoms or through specific patterns of associations. Specifically, two alternative hypotheses were evaluated: a) whether the influence of OCS on functioning would be explained by their mitigating or worsening effect on schizophrenia symptoms (mediation hypothesis); b) whether the impact of OCS on functioning would vary as a function of the severity of the diverse schizophrenia symptoms (moderation hypothesis).

2. Material and methods

2.1. Participants

The study enrolled schizophrenic patients who consecutively sought treatment at the Psychiatric Unit of the University Hospital of Parma from January 2012 to December 2013. Patients were included in the study if 1) they were aged over 17 years; 2) they received a diagnosis of schizophrenia, according to DSM-IV criteria (APA, 2000); 3) a written informed consent to study participation was obtained. Patients were excluded if they were affected by 1) a current mental disorder related to a general mental condition or to a drug- or alcohol abuse or dependence 2) a cognitive disorder (Mini-Mental State Examination score lower than 25) which could impair the compliance with testing procedures.

Age at onset has been defined as the age of the appearance of the first psychotic symptoms.

Moreover, in order to guarantee that the full range of severity of the obsessive–compulsive dimension was equally represented in the study sample, at least the first 30 patients with absent-mild OCS (Yale-Brown Obsessive–Compulsive Scale (YBOCS) score lower than 16) and the first 30 patients with moderate–severe OCS (YBOCS higher than 15) were included in the study (Goodman et al., 1989).

All patients were treated with antipsychotics. Patients who had moderate–severe OC symptoms also received a serotoninergic medication.

2.2. Procedures

All patients completed: 1) the Structured Clinical Interview for DSM-IV Disorders (SCID-IV) (Mazzi et al., 2000); 2) the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987) for the evaluation of positive, negative and general psychopathology symptoms; 3) the Yale-Brown Obsessive–Compulsive Scale (YBOCS) (Goodman et al., 1989) for the assessment of OCS; 4) the Social and Occupational Functioning Assessment Scale (SOFAS) (APA, 2000) for the evaluation of the level of functioning.

According to DSM-IV diagnostic criteria, recurrent and persistent thoughts that were not related to individual delusional themes and hallucinations and were recognized by patients as intrusive, inappropriate and a product of his/her own mind were considered as obsessions. Similarly, repetitive behaviors that the person felt driven to perform in response to an obsession and that were not interrelated with the content of delusions and/or hallucinations were defined as compulsions.

The study focused on three PANSS scores representing definite schizophrenia symptom dimensions: positive symptoms, negative symptoms, and disorganization. The disorganization score was computed by summing the items of conceptual disorganization (P2) and mannerisms and posturing (G5), according to the criteria suggested by the Schizophrenia Remission Working Group (RSWG) (Andreasen et al., 2005). PANSS general psychopathology and total scores were also computed for descriptive purposes. A trained psychiatrist interviewed patients after the resolution of the acute phase of illness in order to guarantee an adequate cooperation to the assessment.

2.3. Statistical analysis

To evaluate the primary hypotheses of the study, analyses were conducted in three steps.

Firstly, patients were divided into two groups, based on the threshold value corresponding to the inflection point of the fitted curve (YBOCS score = 14) previously found (Tonna et al., 2015a); in fact, increasing OCS were associated with better functioning up to a YBOCS value of 14 and with decreased functioning above this value. Thus, the first group included subjects reporting YBOCS score <14 (absent/mild OCS), whereas the second group included patients with a YBOCS score ≥14 (moderate/severe OCS). The socio-demographic and clinical features of the two groups were compared using the two-tailed Student's t test for continuous variables and Fisher's exact test for categorical variables. We expected the absent/mild OCS group to exhibit higher SOFAS scores than the moderate/high OCS group.

Secondly, we investigated the relationship between YBOCS score, schizophrenia symptoms and SOFAS score in each patient group using Spearman's correlations (two tailed). We expected OCS to be positively related with SOFAS scores in the absent/mild OCS group, but inversely related with functioning in the moderate/high OCS group. Correlations between the primary study variables and socio-demographic features were also computed.

Finally, we examined whether the varying effect of OCS on psychosocial functioning in the two groups a) would be mediated by the severity of schizophrenia symptoms dimensions; or b) would be moderated by the severity of schizophrenia symptoms dimensions. The mediation analysis aims to clarify how or why OCS would influence functioning (i.e., through their potential worsening or ameliorating effect on schizophrenia symptoms); the moderation analyses aims to clarify when or for whom OCS differentially impact functioning (i.e., at high or low levels of schizophrenia symptoms). For these aims, we used Hayes (2013) procedure for indirect (i.e., mediation) and conditional (i.e., moderation) effects. This regression-based procedure makes no assumption about the normality of the data and is tolerant of smaller samples by utilizing 5000 bootstrap resamples to estimate a confidence interval of an effect.

Thus, three mediation analyses (PROCESS for SPSS, Model #4) were performed in each sub-group (i.e., absent/mild OCS group and moderate/high OCS group) in order to assess whether schizophrenia symptoms (PANSS positive, disorganization and negative symptoms: proposed mediators) would mediate the relationship between OC symptom severity (independent variable: YBOCS score) and SOFAS score (dependent variable). Therefore, these mediation analyses could clarify whether OCS influence the severity of the various schizophrenia symptoms, which in turn would impact functioning, in both the absent/mild OCS and moderate/high OCS groups.

Then, three moderation analyses (PROCESS for SPSS, Model #1) were performed in each sub-group to evaluate whether OC symptom severity (independent variable: YBOCS score) predicted functional

impairment (dependent variable: SOFAS score) depending on different levels of schizophrenia symptoms (proposed moderators: PANSS positive, disorganization and negative symptoms scores). For the schizophrenia dimensions X YBOCS score interaction terms, a 95% confidence interval for B (unstandardized regression coefficient) not including zero signifies that the association between YBOCS scores and SOFAS ratings varies depending on the level of schizophrenia symptoms (Hayes, 2013). Thus, these moderation analyses could clarify whether the strength of the effect of OCS on functioning depends on the severity of schizophrenia symptoms, in both the absent/mild OCS and moderate/high OCS groups.

In both sets of analyses, demographic features that were found to be associated with SOFAS scores (i.e., the dependent variable) in correlational analyses were controlled for in the regression models.

All statistical analyses were performed with SPSS for Windows (version 22.0, SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Participants

The present study included 75 patients (28 males, 37.3%). Sixty-nine patients (92%) were treated with oral antipsychotics and the remaining six patients (8%) received a long-acting antipsychotic. Twenty-five patients (33.3%) were receiving a first generation antipsychotic (FGA) and forty-three (57.3%) a second generation antipsychotic (SGA). Seven patients (9.4%) were treated with clozapine. The mean chlorpromazine equivalent dose was 432 ± 121 mg/day.

Forty-two patients were classified as absent/mild OCS group, and thirty-three as moderate/high OCS group. The historical, clinical and socio-demographical features of the two groups are reported in Table 1.

As expected, and in line with our previous study (Tonna et al., 2015a) SOFAS scores were higher in the absent/mild OCS group. Not surprisingly, employment status was also higher in the absent/mild OCS group, since SOFAS score also includes job as indicator of social functioning. The two groups did not differ with regard to any PANSS clinical dimensions except for general psychopathological score, which was higher in the moderate/high OCS group (Table 1). This dimension includes heterogeneous symptoms, such as anxiety and agitation, which are likely secondary to other dimensions.

3.2. Correlations among the primary study variables

The patterns of correlation among the study variables in the absent/mild OCS group and in the moderate/high OCS group are reported, respectively, in Tables 2 and 3. As expected, increasing OCS were associated with higher SOFAS scores in the absent/mild OCS group, but with worse functioning in the moderate/high OCS group. In the absent/mild OCS group positive, negative and disorganization symptoms were associated with worse psychosocial functioning, and in the moderate/high OCS group disorganization symptoms were inversely related with functioning. OCS were unrelated with schizophrenia symptoms in both groups. Lower psychosocial functioning was also associated with greater number of prior hospitalizations in both groups, as well as with male gender in the absent/mild OCS group only (41.7 ± 14.7 vs. 51.6 ± 10.3; $t = -2.25$, $p = .03$). Therefore, these socio-demographic features, as appropriate, were entered as covariates in all the subsequent analyses where SOFAS score was the dependent variable.

3.3. Mediation analyses

Having found that OCS severity was positively related with higher SOFAS score in the absent/mild OCS group, and negatively related with SOFAS scores in the moderate/severe OCS group, we next evaluated whether schizophrenic symptoms mediated the relationship between OCS severity (Y-BOCS total score) and social functioning (SOFAS score) using Hayes (2013) bootstrapping procedure for indirect effects (PROCESS Model #4). After controlling for sex and number of prior hospitalizations, OCS severity directly predicted better functioning in the absent/mild OCS group, and worse functioning in the moderate/high OC group (respectively: B = 0.89, CI = 0.08–1.71, $R^2 = 33$, $p = .001$; B = −1.1, CI = −1.64 - − .34, $R^2 = .27$, $p = .008$). However, no association was found between Y-BOCS total score and, respectively, PANSS positive, negative and disorganization symptoms scores in any of the models tested, indicating lack of an indirect (i.e., mediated) effect of OCS to functioning through schizophrenia symptoms severity. Thus, in

Table 1
Socio-demographic features in the absent-low (YBOCS < 14) and in the moderate-high (YBOCS ≥ 14) OCS groups.

	YBOCS < 14		YBOCS ≥ 14			
	n = 42		*n* = 33			
	n	%	*n*	%	*F*	*p*
Gender					2.15	.42
Male	28	66.7	19	57.6		
Marital status					0.78	.53
Never married	35	83.3	30	90.9		
Married	4	9.5	1	3.0		
Divorced/widowed	3	7.1	2	6.1		
Employment status					7.36	.01
Never occupied	21	50.0	27	81.8		
Occupied/student	21	50.0	6	18.2		
Living status					5.29	.19
Living alone	3	7.1	3	9.1		
Living with someone	39	92.9	30	90.9		
		Mean ± SD		Mean ± SD	*t*	*p*
Age years		36.21 ± 12.15		37.39 ± 10.19	−0.44	.65
Education years		10.57 ± 3.58		9.58 ± 3.05	0.08	.93
Age at onset years		23.33 ± 6.07		24.85 ± 6.86	−1.01	.31
Illness duration years		12.55 ± 11.03		12.33 ± 10.11	0.08	.91
Hospital admission n°		3.93 ± 3.84		3.70 ± 4.36	0.244	.80
PANSS positive scale		17.19 ± 6.64		17.12 ± 6.04	0.47	.96
PANSS negative scale		25.36 ± 7.72		26.30 ± 8.09	−0.52	.61
PANSS disorganization score		5.38 ± 2.28		5.70 ± 2.96	−0.51	.61
General psychopathology score		42.24 ± 10.90		49.67 ± 12.10	−2.79	.01
SOFAS scores		44.98 ± 14.07		35.55 ± 11.47	3.12	.00

Table 2
Spearman's correlations between SOFAS scores, positive and negative dimensions of schizophrenia and demographic variables in the absent-mild OCS group (YBOCS < 14).

Variables	1.	2.	3.	4.	5.	6.	7.	8	9.	9a.	9b.
1. SOFAS scores	–										
2. PANSS positive scale	−.635**	–									
3. PANSS negative scale	−.570**	.240	–								
4. PANSS Disorganization score	−.527**	.738**	.270	–							
5. General psychopathology score	−.572**	.507**	.428**	.544**	–						
6. Age at onset years	.195	−.036	−.163	−.014	−.014	–					
7. Illness duration years	.010	.162	−.244	.118	.011	−.114	–				
8. Hospital admission n°	−.309*	.231	.253	.283	.213	−.080	.356*	–			
9. YBOCS scores	.390*	−.069	−.163	−.155	−.139	.322*	−.026	−.006	–		
9a. Obsessions	.325*	−.110	−.184	−.084	−.165	.328*	−.083	.059	.859**	–	
9b. Compulsions	.237	.037	.027	.022	.022	.096	.116	−.018	.567**	.261	–

* $p < .05$.
** $p < .001$.

the absent/mild OCS group there was no evidence that OCS positively influence psychosocial functioning by mitigating schizophrenia symptoms (for PANSS positive symptoms: B = −.05, CI = −.49–.40, $R^2 = .001$, $p = .83$; for negative symptoms: B = −.21, CI = −.72–.30, $R^2 = .02$, $p = .41$; for disorganization symptoms: B = −.07, CI = −.23–.08, $R^2 = .02$, $p = .33$). Similarly, in the moderate/high OCS group there was no evidence that OCS negatively influence functioning by worsening schizophrenia symptoms (for PANNS positive symptoms: B = −.22, CI = −.60–.16, $R^2 = .04$, $p = .25$; for negative symptoms: B = −.02, CI = −54–.50, $R^2 = .0002$, $p = .94$; for disorganization symptoms: B = −.003, CI = −.19–.19, $R^2 = .000$, $p = .97$).

3.4. Moderation analyses

Finally, we evaluated whether schizophrenic symptoms interacted with OCS (YBOCS score) in impacting social functioning (SOFAS score), following Hayes (2013) procedure for assessing conditional effects of the moderator (PROCESS Model #1). After controlling for sex and number of prior hospitalizations, no significant interactions were detected between OCS and, respectively, positive and negative symptoms in predicting psychosocial functioning in both the absent/mild OCS group (PANSS positive symptoms X YBOCS scores: B = .02, $p = .58$, CI = −.06–.10; PANSS negative symptoms X YBOCS scores: B = .01, $p = .83$, CI = −.07–.09) and the moderate/severe OCS group (PANSS positive symptoms X YBOCS scores: B = .10, $p = .10$, CI = −.02–.21; PANSS negative symptoms X YBOCS scores: B = −.08, $p = .30$, CI = −.24–. 08). However, OCS and disorganization symptoms significantly interacted in predicting SOFAS scores in both groups. In the absent-mild OCS group, increasing YBOCS scores predicted increased functioning, but this effect was greatest at lower levels of disorganization, and disappeared at higher levels of disorganization (Table 4; Fig. 1, Panel A). Thus, the positive impact of OCS on psychosocial functioning, moving from absent to mild levels of severity, decreased as the intensity of disorganization symptoms increased. The Johnson-Neyman technique was used to identify the specific level of disorganization symptoms where the conditional effect of OCS on functioning loses statistical significance: for individuals with PANSS-Disorganization values >5.5 (representing 47.6% of the sample), mild OCS had no more significant positive effect on psychosocial functioning.

Conversely, in the moderate/severe OCS group increasing OCS severity predicted decreased functioning: but again, this adverse effect of OCS disappeared at higher levels of disorganization (Table 5; Fig. 1, Panel B). Specifically, the Johnson-Neyman technique indicated that for individuals scoring higher than 8.66 on the PANSS disorganization (27.3% of the sample), severe OCS had no more significant adverse effect on SOFAS scores.

4. Discussion

The present study aimed to investigate whether OCS influence psychosocial functioning in schizophrenia independently from the effect exerted by positive, negative and disorganization symptoms or whether OCS and schizophrenic symptoms interact with each-others to affect functioning.

The results extend our previous findings that, among patients with schizophrenia, mild OCS are associated with better psychosocial functioning, while moderate/severe OCS are related with worse psychosocial functioning (Tonna et al., 2015a). Importantly, results further clarify the specific conditions under which this effect is likely to manifest.

Firstly, in keeping with previous research (de Haan et al., 2013a, 2013b; Devi et al., 2015), this study found no correlation between OCS and schizophrenic symptoms,. Specifically, the effect of OCS on functioning was not mediated by the severity of positive, negative or disorganization symptoms. Therefore, the relationship between varying OCS and functioning is not accounted for by their worsening or mitigating effect on the other schizophrenia symptom dimensions.

Table 3
Spearman's correlations between SOFAS scores, positive and negative dimensions of schizophrenia and demographic variables in the moderate–severe OCS group.

Variables	1.	2.	3.	4.	5.	6.	7.	8	9.	9a.	9b.
1. SOFAS scores	–										
2. PANSS positive scale	−.323	–									
3. PANSS negative scale	.015	.083	–								
4. PANSS Disorganization score	−.491**	.631**	.007	–							
5. General psychopathology score	.302	−.018	.338	.073	–						
6. Age at onset years	0.25	−.122	−.166	−.078	−.246	–					
7. Illness duration years	−.265	.175	.094	.314	−.062	−.210	–				
8. Hospital admission n°	−.370*	.141	−.110	.313	.093	−.116	.427*	–			
9. YBOCS scores	−.449**	−.208	−.069	−.024*	.247	.188	−.056	−.121	–		
9a. Obsessions	−.092	−.282	.242	−.148	.187	.102	−.248	−.263	−.011	–	
9b. Compulsions	−.597**	−.020	−.215	.163	.274	.128	.081	.041	−.290	.188	–

* $p < .05$.
** $p < .001$.

Table 4
Interaction between disorganization and obsessive–compulsive dimension in impacting social functioning in the absent-low OCS group (YBOCS < 14).

	B	*SE*	*t*	95% CI
PANSS-Disorg	−2.00	0.67	−2.97**	[−3.37, −0.63]
YBOCS	1.86	0.66	22.84**	[0.53, 3.19]
YBOCS*Disorg	−0.22	0.10	−2.14**	[−0.43, −0.01]
Gender	7.68	3.27	2.35**	[1.05, 14.31]
Number of hospitalizations	−0.76	0.34	−2.27**	[−1.45, −0.08]
Conditional effect on SOFAS:				
Low PANSS-Disorg: 3.09	1.17	0.40	2.91**	[0.35, 1.99]
YBOCS X Med PANSS Disorg: 5.38	0.66	0.31	2.12**	[0.03, 1.30]
High PANSS Disorg: 7.66	0.15	0.38	0.40*	[−0.62, −0.93]

Note: n = 42; Model R^2 = .52, F(5,36) = 11.3, p < .001;
PANSS-Disorg moderator values represent the mean and ±1 SD.
* p < .05.
** p < .01.

Table 5
Interaction between disorganization and obsessive–compulsive dimension in impacting social functioning in the moderate-high OCS group (YBOCS ≥ 14).

	B	*SE*	*t*	95% CI
PANSS-Disorg	−9.22	3.21	−2.87**	[−15.80, −2.63]
YBOCS	−2.55	0.89	−2.87**	[−4.37, −0.73]
YBOCS*Disorg	0.24	0.10	2.37**	[0.03, 0.45]
Number of hospitalizations	−0.34	0.54	−0.64	[−1.45, 0.77]
Conditional Effect on SOFAS:				
Low PANSS-Disorg: 2.73	−1.88	0.62	−3.04**	[−3.15, −0.62]
YBOCS X Med PANSS-Disorg: 5.70	−1.16	0.35	−3.30**	[−1.89, −0.44]
High PANSS-Disorg: 8.66	−0.44	0.22	−1.97*	[−0.90, 0.02]

Note: n = 33; Model R^2 = .57, F(4,28) = 6.76, p = .001; 95% CI = 95% confidence interval.
PANSS-Disorg moderator values represent the mean and ±1 SD.
* p < .05.
** p < .01.

Secondly, we found a significant interaction between OCS and disorganization dimension (but not the negative and positive dimensions) in impacting social functioning: the OCS effect on functioning depends on the concurrent severity of disorganization symptoms. In the present study, mild OCS (YBOCS ≤ 14) predicted increasing SOFAS scores only when disorganization symptoms were low; conversely, as disorganization increased, mild OCS were unrelated with SOFAS scores. In the same vein, moderate to severe OCS (YBOCS > 14) predicted decreasing SOFAS scores only when disorganization symptoms were low, but not in the presence of severe disorganization symptoms (see Fig. 1). This suggests that, while at low levels of disorganization OCS can impact social functioning, at high levels of disorganization the effect of OCS on functioning is no more apparent. Therefore, only in patients with low levels of disorganization symptoms did mild OCS improve functioning, while moderate–severe OCS worsened it. In contrast, in patients with greater disorganization symptoms both the positive and negative impact of, respectively, mild and severe OCS on functioning disappeared. Thus, the previously described reverse U-shaped curve between OCS and social functioning (Tonna et al., 2015a) occurs only among patients with mild disorganization symptoms, but not among patients with severe disorganization symptoms. These findings suggest that severe disorganization symptoms might have such a strong impact on social functionality to disguise the effect of OCS. However, when the disorganization is low varying levels of OCS significantly affect psychosocial functioning in schizophrenia.

In contrast, in the present study OCS do not appear to interact with positive and negative symptoms on levels of functionality.

Disorganized thinking and behavior are heritable (Romney, 1990; Shenton et al., 1989), more pronounced during acute exacerbations but relatively persistent, and associated with poor outcome (Tandon et al., 2009).

Functional impairment due to mild symptoms of disorganization could be compensated by mild OCS through a sort of "obsessive organization": rigid rituals and compulsions or polarization on specific obsessive themes, noteworthy, mostly symmetry and order contents (Tonna et al., in press) may confer a certain functional order and stability able to counterbalance the functional impairment sustained by the underlying thought and behavioral disorganization process. However, this "obsessive organization" fails to induce a positive effect of functioning if the OCS are moderate/severe: in these patients social functioning worsen due to concomitant effect of mild disorganization and moderate/severe OCS, which significantly interfere with occupational functioning or usual social activities or relationships.

From this viewpoint, mild OCS may constitute a help against psychosis as claimed by pioneers of clinical psychiatry (Rosen, 1957; Stengel, 1945) only for less severe disorganization symptoms. Interestingly, recent studies have suggested a complex interaction between

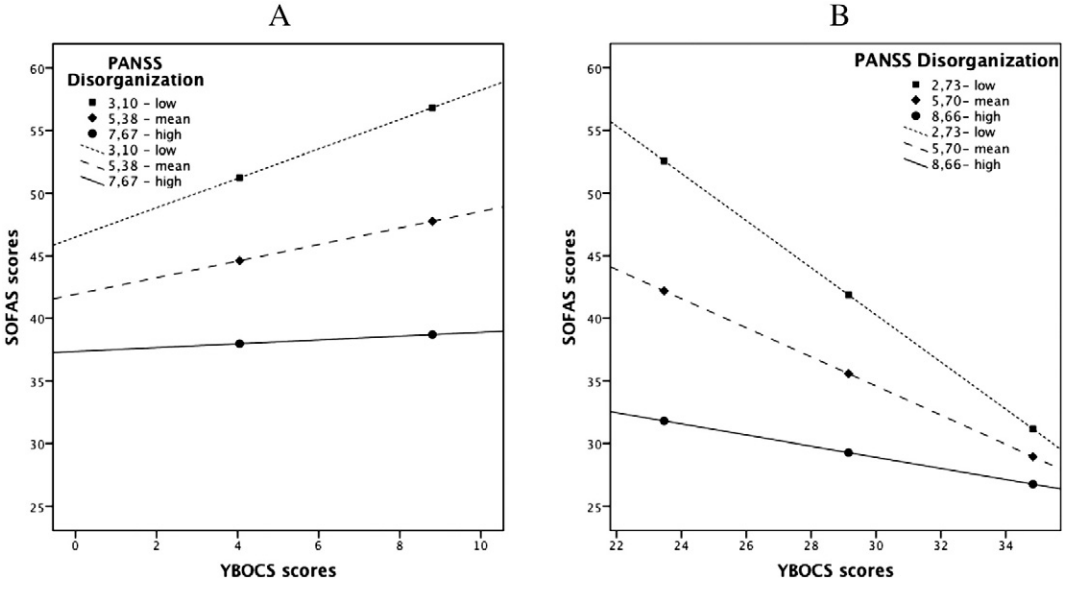

Fig. 1. Interaction between disorganization and obsessive–compulsive dimension in impacting social functioning in the absent-low OCS group (YBOCS < 14; Panel A) and in the moderate–high OCS group (YBOCS ≥ 14; Panel B).

disorganized symptoms and cognitive pathways with a decrease in cognitive functions when conceptual disorganization increases (Minor and Lysaker, 2014). Specifically, conceptual disorganization appears as a moderating factor in the relationship between neurocognition and metacognition (Minor et al., 2015). Future research needs to investigate if the complex interaction between OC and disorganization dimension in influencing functioning may involve cognitive processes.

This view emphasizes the complex heterogeneity inherent to a dimensional approach to schizophrenia, suggesting how its clinical manifestations, so diverse and variable (van der Velde, 1976; Wyatt et al., 1988), may be viewed as a dynamic process of interactions between a constellation of relatively distinct dimensions (Keshavan et al., 2008; Tandon et al., 2009).

Moreover, if confirmed in larger samples, these findings might have important clinical implications; since mild OCS contribute to lesser functional decline in patients with low disorganized psychosis, they may favor the constitution of a subtype of schizophrenia with a better functioning. In keeping with the historical concept of "pseudoneurotic schizophrenia" (Hoch and Polatin, 1949), we speculate that obsessive dimension might have a pathoplastic influence (O'Connor et al., 2009; Tonna et al., 2015b); that is, OCS or OC spectrum disorders (somatoform disorders, chronic tic disorders, eating disorders), which occur more frequently in "schizo-obsessive" patients" (Poyurovsky et al., 2006), could balance the effect of low disorganization symptoms.

Future research is needed to clarify if OCS may also represent a clinical feature of the prodromal phases of schizophrenia, as suggested by earlier psychopathologists (Bleuler, 1911; Mayer-Gross, 1924; Westphal, 1878), preceding the onset of psychosis (Meier et al., 2014).

The present study should be considered in light of some limitations. First, caution should be used in drawing firm conclusions from this study due to its small sample size and composition (patients were included in the study also according to the Y-BOCS score). Second, cognitive dimension was not assessed in the present study, therefore the effect of OCS on functioning was not corrected by cognitive dysfunction. Third, the cross-sectional design of the study cannot rule out the possibility that the interplay between OCS and other dimensions of schizophrenia may change over time or may have a phase-dependent effect. Fourth, in the present study disorganization dimension has been assessed using the RSWG criteria (Andreasen et al., 2005), represented by two clinician-rated items (P2-G5). These items are included in previous broader models of PANSS cognitive and disorganization dimensions (Bell et al., 1994). The adoption of this narrow definition of PANSS disorganization is supported by several recent studies about functioning outcome in schizophrenia (Helldin et al., 2007; Oorschot et al., 2012; Karow et al., 2012).

In conclusion, in patients with schizophrenia the strength of the association between OCS and social functioning varies as a function of the severity of concurrent disorganization symptoms: only in patients with low disorganization symptoms can OCS influence functioning, with mild OCS improving and severe OCS worsening social functioning. Therefore, the present study suggests that in patients with schizophrenia, psychosocial functioning depends at least in part on the interaction between disorganization and OC symptoms.

Contributors

All the authors of this article had access to all study data, are responsible for all contents of the article, and had authority over manuscript preparation and the decision to submit the manuscript for publication and all listed authors have approved the submission of the final manuscript to the journal;

Matteo Tonna and Carlo Marchesi designed the study.
Rebecca Ottoni and Francesca Paglia evaluated the patients at the enrollment.
Matteo Tonna and Rebecca Ottoni reviewed the literature.
Matteo Tonna and Carlo Marchesi managed the literature.
Chiara De Panfilis and Paolo Ossola undertook the statistical analysis.
Matteo Tonna and Carlo Marchesi wrote the first draft of the manuscript.

Role of funding source

The authors declared that no authors received funding for the research.

Conflict of interest

All the authors declared, that no authors received funding for the research and had financial involvement that could represent potential conflict of interest.

Acknowledgments

The authors would like to thank all the staff of the Department of Neuroscience, Psychiatric Unit, University of Parma and all the undergraduate students. Without those help it would be impossible to complete the enrolment.

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