Inhibitory Processes in Normal and Disordered Thought

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Background

Inhibitory processes are found at different levels of behaviour and are crucial for survival and the functioning of cognitive processes. The main purpose of inhibition is to prevent interference factors from disturbing individual goals and actions at different levels of cognition [1]. In schizophrenia inhibitory control is thought to be disturbed [2] and is hypothesised to be involved with specific psychopathological symptoms, such as thought disorder (FTD) [3-4]. However, since inhibitory processes act at many different levels of behaviour and cognition, it appears to be very unlikely that a general inhibition deficit is to be found in schizophrenia. The purpose of this study was the attempt to delimit at what level of cognitive functioning a deficit in inhibition is found in schizophrenia in comparison to healthy controls. Additionally, it was aimed to compare inhibitory processes to formal thought disorder. Using a within-subject design, inhibitory processes involved at selective attention, orienting, working memory and executive control were measured using five different behavioural tasks.

Methods

Subjects: 36 patients diagnosed with schizophrenia and 21 controls matched for gender, age and education participated in the study. FTD was evaluated by the item 4 conceptual disorganisation- of the BPRS, a median-split was conducted which divided groups into high and low-FTD, which resulted in 19 N-FTD and 17 FTD patients (See Table 1).

Tasks: Tasks were performed by each subject in two days:

Day 1: Word-naming Negative Priming Task (Selective attention), Delayed Response Task (spatial working memory), Stroop Task (Executive Control),

Day 2: Continuous Performance Task- Version 3-7 (Working Memory), 3- Posner's Orienting Paradigm (Orienting).

Table 1 – Mean values for disease variables and SD for patients divided into FTD and N-FTD according to BPRS Item 4.

	N-FTD (N=19)		FTD (N=17)		
	Mean	SD	Mean	SD	p
Age (y)	29,11	8,72	32,24	8,80	0,29
Education (y)	11,47	1,87	10,76	1,75	0,25
Neuroleptic Dose (CPZ)	539,42	501,56	1020,71	883,58	0,05*
Number of Hospitalisations	3,16	5,46	2,47	2,15	0,58
Length of Disease (y)	4,07	5,37	6,22	7,37	0,32
Time of Hospitalisation (w)	6,84	7,24	9,18	9,85	0,42
Age of Onset (y)	24,50	7,39	26,29	6,02	0,44
BPRS – Total Fitted Scores	42,95	8,55	53,76	10,01	0,00*

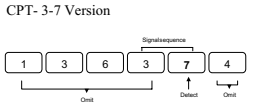
(y)= years; (w)= weeks; (CPZ)= mean Chlorpromazine equivalent dose in mg.
A t-Student statistical analysis for independent samples was conducted to compare both groups. The t-value and respective p are represented in the table. Significant differences are marked with an (*) for p<.05.

Results

The results showed that schizophrenic patients, especially those with thought disorder have inhibitory deficits in tasks where working memory and executive control is required, but not in selective attention or orienting.

Negative Priming Task and Posner's Orienting Paradigm: no differences between patients and controls. No differences in subgroups divided into high and low FTD.

CPT: Four non-parametric tests (Kruskal-Wallis) using group (NTD, N-FTD and controls) as independent variable and false alarm (FA) rate, d', ß- resposne criterion and hit rate (HR) as dependent variables were used. A significant main effect for FA (H (2, N= 57) = 10,53 p =,0052) was found. Contrast analysis revealed that high FTD patients significantly differ from controls by having increased numbers of false alarms. In relation to HR a main effect was found H (2, N= 57) = 19,74, p =,0001 and both groups of patients differed from controls, by having decreased hit rate. The same pattern was found for d' (H (2, N= 57) = 18,69 p =,0001). No differences were found for response criterion ß. (See Fig1)



Sensitivity Index d'

Thought Disorder	Median	Lower Quartile	Upper Quartile
low	4,23	3,86	4,58
high	3,75	3,06	4,05
Controls	4,74	4,56	4,74

Hit Rates

Thought Disorder	Median	Lower Quartile	Upper Quartile
low	96,67	93,33	1,11
high	90,00	86,67	2,78
Controls	100	100	100

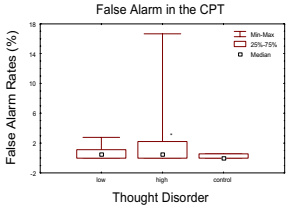


Figure 1:
Representation of the CPT and False alarm rates, d' and hit rates for patients divided according to formal thought discorder in comparison to controls.

Conclusions

Deficits in inhibitory processes were found for patients with formal thought disorder in tasks which are involving working memory and executive control, but not selective attention and orienting. This confirms the suggestion that inhibitory deficits are not a generalised finding in schizophrenia, specially in patients with formal thought disorder. According to neurobiological evidence [5-7] working memory and executive control involves prefrontal cortex activation in normal volunteers. This activation is disturbed in schizophrenic patients [4, 8, 9]. We can thus suggest that inhibitory deficits are 1) related to specific psychopathological symptoms such as thought disorder and 2) related to cognitive processes depending on prefrontal areas or networks. Future studies using other cognitive neuroscience methods are needed to confirm the suggestion of the relationship between inhibitory deficits, PFC dysfunction and thought disorder in schizophrenia.

Results

DRT: A one-way ANOVA using group as independent variable and mean test scores as dependent variable was used. Results revealed a significant main effect (F(2,52)=4,25; p<,0195). Newman-Keuls post-hoc test showed that high FTD patients differed from controls by having increased mean test scores. Low FTD patients did not differ from controls (see Fig. 2).

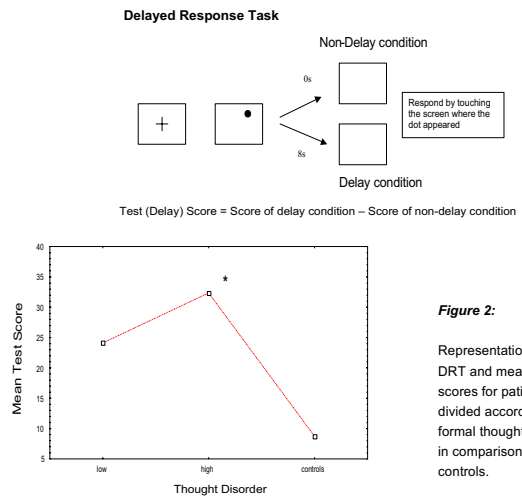


Figure 2:
Representation of the DRT and mean test scores for patients divided according to formal thought disorder in comparison to controls.

STROOP: An ANOVA using group as independent variable and errors in the incongruent condition (%) as dependent variable was used. No significant difference between group was found, although FTD patients showed more errors than N-FTD and controls, p=.12 (See Fig. 3).

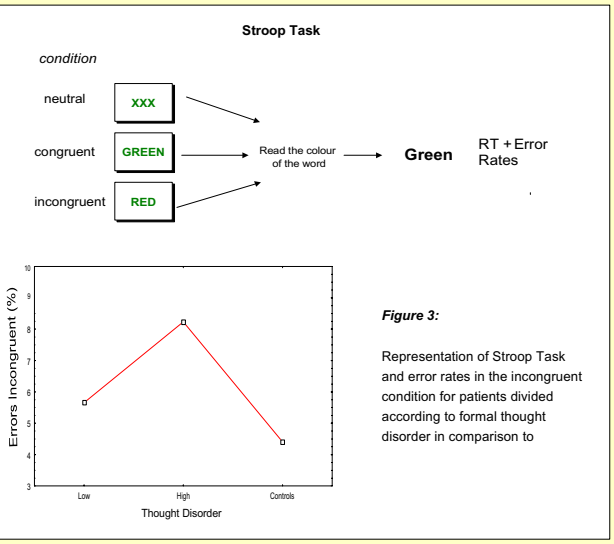


Figure 3:
Representation of Stroop Task and error rates in the incongruent condition for patients divided according to formal thought disorder in comparison to

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