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ARTICLE

Effects of atypical neuroleptics on alertness and visual orienting in stabilized schizophrenic patients: a preliminary study

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Abstract

It has been shown that schizophrenic patients treated with conventional neuroleptics display a general slowness in latency in simple reaction-time tasks and a disengagement deficit in visual-orienting tasks. Yet, the influence of atypical neuroleptics on attention is still controversial. The purpose of our study was to investigate the effect of atypical neuroleptics in tasks requiring alertness, selective attention or visual orienting. Thirteen stabilized schizophrenic patients receiving atypical neuroleptics were compared to 13 healthy controls matched for age, gender, and study level, in a choice reaction time (CRT) task and a visual-orienting task [cued target detection (CTD) task]. The results showed that patients and controls obtained comparable reaction times (RTs) in the CRT task. In the CTD task, both groups had comparable RTs but the presence of invalid cues caused a greater attentional cost in both visual fields for patients compared to controls, indicating a symmetrical disengagement deficit. To conclude, patients treated with atypical neuroleptics had a phasic alertness ability similar to controls. By contrast, an impairment of disengagement was present in those patients. Thus, atypical neuroleptics could have a positive influence on certain but not all attentional domains.

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Key words: Alertness, atypical neuroleptics, choice reaction time, schizophrenia, visual orienting.

Introduction

Abnormalities of attention in schizophrenia are well documented. They range from difficulties in sustained and selective attention to impaired performance in tasks involving spatial covert attention (Lussier and Stip, 2001; Park et al., 2002; Sapir et al., 2001). These difficulties are a major source of disabilities in everyday life for the patients. For instance, vigilance, verbal memory and early visual processing are significant predictors of social problem solving (Addington et al., 1998; Addington and Addington, 1999). Until recently, it was uncertain whether treatments which were clinically efficient in schizophrenia had a positive effect on cognitive disorders. Indeed, conventional neuroleptics have been shown to improve only some aspects of attention, mainly through an indirect effect of clinical benefit (Cassens et al., 1990; Spohn and Strauss, 1989). There is now increasing interest in the influence of novel antipsychotics on cognition. Atypical neuroleptics are known to induce less extrapyramidal side-effects than conventional neuroleptics and could be more effective in the treatment of cognitive impairment (Keefe et al., 1999; Purdon, 1999). However, novel antipsychotics may not have positive effects on all cognitive functions (Meltzer and McGurk, 1999), and the influence of atypical neuroleptics have never been explored on distinct attentional mechanisms.

Attention encompasses a number of sub-processes ranging from the preattentive mechanisms of detection to complex attentional processes involving selective attention and executive functions. Among early components of attention, alertness can be defined as the ability to 'attend to a stimulus in several different ways' (Coull, 1998). It is considered as the most basic aspect of attention representing the capacity to control

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wakefulness and the ability to maintain a certain level of vigilance when expecting a stimulus. Reaction time (RT) studies are good indicators of the vigilance and the alertness state (Sturm and Willmes, 2001). In choice reaction time (CRT) tasks, both preparatory stages of attention such as the phasic alertness and selective attention are studied. The subject is generally asked to focus selectively on one stimulus feature (target), while ignoring another (distractor). The presence of a warning signal increases the level of alertness and the response readiness and hence invariably speeds up the RT to the upcoming target (Posner, 1986). However, the warning signal provides no information about the nature of the upcoming stimulus. The facilitation induced by the warning signal seems to be optimal where there is a preparatory interval of 200–300 ms (Boff and Lincoln, 1988). This preparatory interval (or interstimuli interval; ISI) has different effects depending on whether it is short or long, varied or fixed. In normal subjects, in a simple RT task, responses are initiated more quickly if the ISI between the warning (S1) and the imperative stimulus (S2) is short (<3 s) compared to longer ISI, and in trials in which the S1–S2 interval is constant rather than random. This improved performance is thought to be due to the temporal predictability of the imperative stimulus.

Spatial attention involves processes where the attentional system is capable of attending to local events (Witte and Marrocco, 1997). Posner and Cohen (1984) were the first to investigate alertness through spatial orienting with a cuing effect. In the standard paradigm the subject is asked to fixate a central point (or square) while targets appear in either visual field. The targets are preceded by external cues (eccentric to the point of fixation), which rapidly and automatically summons attention. Most frequently, the cue correctly signals the location of an upcoming target (valid cue) but it sometimes misdirects attention to the opposite visual field (invalid cue). For healthy controls, valid cues decrease the manual RT to the target in comparison to invalid cues. Valid cues engage the attention to the correct localization. Invalid cues, on the other hand, imply disengaging from the hemi-field related to the cue and shifting back to the contra-lateral visual field. This supplementary shift increases the RT (Gold et al. 1992; Posner and Cohen, 1984). Neutral cues are used to measure the attentional benefit, reflecting the ability to engage attention and, the attentional cost, reflecting the ability to disengage (Clark et al., 1989).

Both alertness and visuospatial orienting are impaired in schizophrenia. Initially, alertness was studied in simple and choice RT tasks showing that schizophrenic patients treated with conventional neuroleptics or under no medication exhibited a general slowness (Krieger et al., 2001; Ngan and Liddle, 2000; Nuechterlein, 1977). Moreover, patients with schizophrenia generally fail to use the advance information about the temporal predictability of the imperative stimulus provided by the warning signal to speed up the response (Rodnick and Shakow, 1940). Few studies have been carried out on the effects of atypical treatments on alertness. Stip et al. (1999) have shown a favourable effect of clozapine and risperidone on selective attention (visual search task) in a group of schizophrenic patients, initially assessed when receiving conventional neuroleptics, then reassessed after 6 wk (S1) and 24 wk (S2) of clozapine (S1 = 245 mg/d, S2 = 367 mg/d) or risperidone (S1 = 7 mg/d, S2 = 9 mg/d). Zahn et al. (1994) have shown in a group of schizophrenic patients that olanzapine has no effect on simple or choice RT compared to placebo or fluphenazine. Further clarification of the effects of atypical neuroleptics on the early components of attention is warranted.

In spatial orienting, studies on neuroleptic treatment have produced controversial results. Posner et al. (1988) used this spatial cuing paradigm to investigate the processes of selective attention in patients with schizophrenia. The authors observed a lateralized deficit in the invalid component of the task, i.e. patients with schizophrenia were slower in responding to right visual field targets when attention was cued initially to the left. Posner interpreted this result as a left-hemisphere disengagement deficit analogous to what was seen in patients with left parietal lesions (Posner et al., 1984). A similar pattern of response was found in chronic never-medicated schizophrenic patients (Potkin et al., 1989). However, this result is still controversial. In the same type of task, a group of neuroleptic-treated schizophrenic patients in remission exhibited a general slowness but not the asymmetrical abnormalities previously detected (Strauss et al., 1991). The authors explained their result by the fact that they conducted their test on a group treated with neuroleptics while one quarter of Posner's patients were not being treated at the time of the test. Moreover, Posner studied acute patients while Strauss included patients in substantial remission. Strauss et al. (1991) concluded that the left-hemisphere deficit found by Posner in schizophrenic patients was most certainly limited to periods of florid illness and that neuroleptics appear to offset this deficit in schizophrenia. Strauss's results were confirmed by Nestor et al. (1992) and Maruff et al. (1995) in medicated patients. Finally Carter et al. (1992), in a group of unmedicated patients, found a lateralized deficit with an exogenous

orienting task as previously used by Posner et al. (1988) and an absence of lateralized deficit when patients perform an endogenous orienting task (the difference between the two tasks consisting in equal proportion of valid and invalid cues in the former and more valid than invalid cues for the latter). As far as we know, no study has investigated the influence of atypical neuroleptics on covert orienting tasks.

We investigated the performance of schizophrenic patients treated with atypical neuroleptics and healthy controls in two attentional tasks, each of them used different levels of alerting: (1) a CRT task using an uninformative cue including two preparatory delays and (2) a detection task using an informative cue.

According to the literature, schizophrenic patients have a slower RT when compared to controls. We hypothesized that atypical neuroleptics would improve RT performance. In the visual-orienting task, we expected to confirm the results recorded in previous studies showing a general slowness but no asymmetrical deficit in schizophrenic patients treated with conventional neuroleptics. A second hypothesis, drawn from Strauss et al.'s (1991) findings, assumes that disengagement is not influenced by neuroleptic treatments. Therefore, we hypothesized that medicated patients should exhibit longer RTs in the invalid condition (when compared to the neutral cue).

Material and methods

Participants

Thirteen male schizophrenic patients, who met DSM-IV criteria using the DIGS standardized interview (Nurnberger et al., 1994), were recruited from the Department of Psychiatry at the University Unit of Sainte-Anne Hospital (SHU, Paris, France).

Their mean age was 25.2 ($\pm$4.7) yr and they had a mean duration of illness of 3.9 ($\pm$3.3) yr, since their first psychotic symptoms. All patients had been taking stable dosage of atypical neuroleptics for a mean duration of 9$\pm$11 months (see Table 1). Mean dosages cannot be expressed in chlorpromazine equivalent since this equivalence is controversial for atypical neuroleptics.

Their mean study level was 12.7 ($\pm$2.36) yr of education. The patients had to meet the following requirements: (1) be less than 50 yr of age; (2) have no evidence of mental retardation (total IQ$>$70); (3) be taking only one neuroleptic and no other treatment; (4) if receiving risperidone, to be treated with low doses; (5) have no evidence of organic brain pathology. We excluded patients with patent extrapyramidal symptoms (EPS) revealed by a score of over 0.9 on the Simpson–Angus Scale (Simpson and Angus, 1970) and patients who had formerly undergone electroconvulsive therapy. Finally, we excluded patients with any history of substance abuse or dependence, and consumption of psychoactive substance including cannabis.

Table 1. Medication regimens for patients

Patient	Atypical neuroleptic	Dosage (mg/d)	Duration of treatment (months)
1	Risperidone	2	24.0
2	Amisulpride	100	1.0
3	Olanzapine	7.5	1.0
4	Amisulpride	200	24.0
5	Clozapine	450	36.0
6	Olanzapine	7.5	9.0
7	Clozapine	500	6.0
8	Amisulpride	100	6.0
9	Olanzapine	15	0.5
10	Olanzapine	10	1.5
11	Risperidone	2	3.0
12	Risperidone	3	3.0
13	Risperidone	3	3.0

The Positive And Negative Syndrome Scale [PANSS; Kay and Opler, 1987; Lépine et al., 1989 (French version)] was used to assess schizophrenic symptoms at the time of the neuropsychological testing. The Global Assessment Functioning Scale (GAF; Endicott et al., 1976) was applied to all patients.

Thirteen healthy controls were strictly matched to the patients for age (24.2$\pm$3 yr), gender and years of education (13.5$\pm$2.7 yr). The absence of psychiatric pathology (Axis 1) was assessed using the Structured Clinical Interview for DSM-III-R non-patient (SCID-NP) conducted by one of the two trained psychologists (C.D. or D.W.). The controls' first-degree relatives also had to be free of any mental or neurological disorders.

For both patients and controls, substance consumption was checked using urinary analysis on the day of the test. Both groups were assessed on the IQ scale (short version of the WAIS-R; Britton and Savage, 1966), which was used to measure global cognitive functioning.

All subjects gave their written informed consent. The study was approved by the local ethics committee, the Comité Consultatif de Protection des Personnes se prêtant à une Recherche Biomédicale (CCPPRB) at the Pitié-Salpétrière Hospital (Paris). Patients and subjects were treated according to the Declaration of Helsinki and its subsequent amendments.

Apparatus

Subjects sat in a quiet room, 60 cm away from a 21-in. monitor on which the tasks were displayed. The session lasted 26 min and was held between 09:00 and 10:00 hours.

Test procedure

CRT task

Each block of trials lasted 6 min. The stimulus displayed in the centre of the screen was a white cross (warning signal, S1, 25×25 mm; duration 50 ms), a red square (target, $n = 66$) or a green square (distractor, $n = 22$) (S2, 28×28 mm; duration of onset 500 ms). Two conditions were tested with two different ISIs: ISI 500 (S1–S2 delay set at 500 ms); ISI 2000 (S1–S2 delay set at 2000 ms).

Inter-trial intervals varied from 1 to 1.5 s. A training session including 10 trials was held just before the task.

CTD task

This task was a modified version of Posner's paradigm (Witte and Marrocco, 1997). Two square outlines and the central fixation square were displayed at the start of the trial. Subjects were required to fixate on a yellow central square (16×16 mm) throughout the trial. After 500–1500 ms (determined randomly), brightening of one of the two peripheral squares was used as the cue. The subjects were instructed to press the response key whenever they detect a target (a white cross). The target was displayed 300–500 ms after the onset of the cue (Stimulus Onset Asynchrony; SOA). This pseudo-random delay was intended to avoid a learning effect that may have been induced by repetitive intervals. Each block consisted of 160 trials, balanced for right and left: 50% were valid (same hemi-field as the cue), 12.5% were invalid (opposite hemi-field to the cue), 12.5% were double cued (sometimes referred to as 'neutral' in the literature), inducing a non-spatially oriented warning signal (Witte and Marrocco, 1997), 12.5% were central and 12.5% were uncued conditions (i.e. target displayed without being pre-cued). Response preparation is reflected by the difference in RT between valid and invalid trials (Validity Index), and double-cue trials (i.e. with cues on both sides) and no cue trials (Alertness Index). Finally, the spatial effect was measured as follows: no cue–central cue. In order to examine the influence of valid and invalid cues, attentional benefit and cost were computed. Attentional benefit was calculated as follows: RT valid–RT double-cued trials, whereas cost was defined as RT invalid–RT double cued. Inter-trial interval varied randomly between 1600 and 2500 ms. Subjects first completed a training session of 20 trials.

Data analysis

Responses faster than 100 ms (anticipatory responses) and slower than 1500 ms were discarded from the analysis. ANOVA for repeated measures was performed on CRTs, with the two groups as a between-subject factor and the two conditions (500, 2000 ms) and with warning vs. no warning as two within-factors.

To test a possible process of inhibition of return with the CTD task, a phenomenon characterized by slow responding to targets in recently cued locations, RT in valid conditions was compared to invalid conditions, separately for the extreme SOA values: 300 and 500 ms.

RTs in the CTD data were compared for patients and controls using ANOVA with group (schizophrenics and controls) as the between-subject factor and cue (valid, invalid, uncued, double, neutral) as the within-subject factor. If significant effects were found, pairwise comparisons between conditions were performed using Bonferroni correction. Indexes and visual fields were compared using one-way ANOVA.

Results

Clinical data and IQ scores

Patients' mean PANSS scores were as follows: positive score = 12.8 ($\pm$5.8), negative score = 19.2 ($\pm$8.7), general score = 31.8 ($\pm$7.2) and total score = 63.8 ($\pm$17.2).

Patients' mean GAF score was 51.2 ($\pm$18). Extrapyramidal side-effects were evaluated using the Simpson–Angus Scale and no difference was found between the two groups (schizophrenics: 0.6 ± 0.4 vs. controls: 0.2 ± 0.2; $p = 0.08$).

As regards to the verbal IQ score, schizophrenics produced lower scores than controls (95.4 ± 11.8 vs. 103.4 ± 7.5), but this difference did not reach significance ($p < 0.06$). However, for the performance IQ and the total IQ, patients had significantly lower scores: 93.5 ± 14.9 vs. 120.5 ± 23.6 ($p < 0.004$); 94.3 ± 11.2 vs. 111.5 ± 13.1 ($p < 0.003$) respectively.

CRT task (see Table 2)

The analysis showed no main effect of group [$F(1, 24) = 0.51$, $p > 0.48$], suggesting that schizophrenics have RTs comparable to controls. There was no ISI (500 or 2000 ms) $\times$ group interaction [$F(1, 24) = 0.58$, $p > 0.45$]. There was no warning

Table 2. Choice reaction time task: mean reaction time and S.D. for schizophrenics and controls

	Schizophrenics ($n=13$)		Controls ($n=13$)	
	ISI 500	ISI 2000	ISI 500	ISI 2000
No warning (mean ± S.D.)	403.7 ± 61.6	450.9 ± 75.2	400.8 ± 104.7	420.8 ± 120.3
With warning (mean ± S.D.)	366.5 ± 62.5	423.5 ± 61.61	335.5 ± 97.5	392.3 ± 108.7
Alertness Index (mean ± S.D.)	37.2 ± 26.6	27.4 ± 30.7	65.3 ± 58.5	28.5 ± 33.8

(with or without) × group interaction [$F(1,24)=1.15$, $p>0.29$], indicating that both group had the same pattern of responses in each condition. The effect of ISI × warning was significant [$F(1,24)=10$, $p<0.004$] suggesting that the warning effect was more effective during the trial with the short ISI, than during block with the long ISI. The ISI × warning × group effect was almost significant [$F(1,24)=3.35$, $p<0.079$] indicating that controls tend to better use the warning signal than schizophrenics to improve their RTs.

CDT task (see Table 3)

There was no effect of group [$F(1,24)=0.63$, $p<0.4$], showing that schizophrenics had RTs comparable to controls. However, cue type was significant [$F(4,96)=29.36$, $p<0.0001$], with faster RTs for validly cued targets than for double, invalid, central or uncued. The group × cue type interaction did not reach significance [$F(4,96)=1.91$, $p=0.12$].

No inhibition of return effect was observed. Patients and controls exhibited a shorter RT time for valid trials compared to invalid trials for both 300 and 500 ms (results not shown). There was no interaction group × SOA (300, 500) × condition [$F(1,24)=1.3$, $p=0.27$], The schizophrenic patient group exhibited a greater attentional cost than controls [$F(1,24)=6.76$, $p<0.016$). This variable indicates the influence of the invalid cue compared to the neutral cue. Schizophrenic patients exhibited longer RTs than healthy controls in the invalid conditions (when compared to the double-cue condition). Neither groups differed in terms of benefit. There were no difference between groups for validity, spatial or alertness index. Finally, there was no main field effect, indicating that both groups performed the same way in both right and left visuals fields whatever the condition.

We analysed the data regarding the clinical symptoms (positive symptoms, negative symptoms and disorganization). We found no correlation with the RT in any conditions (non-significant).

Table 3. Cued detection task: mean reaction time and S.D. for schizophrenics and controls

	Schizophrenics ($n=13$)	Controls ($n=13$)
Valid	309.3 ± 43.8	289.7 ± 49.8
Invalid	358.1 ± 44.1	328.6 ± 43.8
Double cue	325.6 ± 56.1	318.0 ± 46.7
Uncued	350.6 ± 62.6	348.0 ± 52.3
Central	349.4 ± 55.7	334.6 ± 47.7
Alertness Index	25.0 ± 23.1	30.0 ± 33.8
Validity Index	48.8 ± 17.8	38.8 ± 17.4
Attentional benefit	16.3 ± 21	28.2 ± 18.9
Attentional cost	−32.4 ± 23.9	−10.6 ± 18.5**

** $p<0.01$.

Discussion

The aim of this work was to investigate alertness and orienting in schizophrenic patients treated with atypical neuroleptics compared to healthy controls. The main results show that schizophrenic patients and controls displayed comparable RTs in the CRT task regardless of the preparatory delay allowed and whether or not there was a warning stimulus. In the CTD task, schizophrenic patients exhibited a greater attentional cost with no asymmetrical deficit.

A number of mechanisms are studied in the CRT task. They are as follows: the ability to use the warning signal to enhance the level of alertness, the ability to use temporal predictability of the upcoming stimulus to prepare for action and finally, the ability to select the target and ignore the distractor.

The most significant result is that, contrary to our expectations, the schizophrenic patients are as accurate

and as quick as the controls in CRT tasks. This result is consistent with Fuller and Jahanshahi, (1999) who found no significant difference between schizophrenic medicated patients and controls in an uncued CRT task with ISI ranging from 200 to 3200 ms. The authors concluded that this result was accounted for by the fact that the task was not too demanding. Our task used a warning which was not an informative cue and can be compared to their uncued condition. Moreover, this good performance is thought to be due to the temporal predictability of the imperative stimulus. Indeed, normal controls are known to initiate faster responses in the trials where the interval between the warning signal and the target is kept constant rather than varying randomly throughout trials (Rodnick and Shakow, 1940). As seen by the Alertness Index, the RTs are improved in presence of the warning. However, the difference between the two groups is almost significant suggesting that the schizophrenic patients do not benefit from the warning signal to improve their RT, to the same extent than the controls. Optimum facilitation occurs at 500 ms for both patients and controls. During the long ISI condition (2000 ms), the warning seemed less effective. This is in keeping with the results of Boff and Lincoln (1988) who have suggested that alertness is at its optimum level when ISI are short (around 200–300 ms) rather than long (1500–2000 ms). Finally, patients made comparable errors to controls (results not shown) indicating no sustained attention deficit and no interference through aberrant stimuli when responding. Therefore, the findings suggest that schizophrenic patients treated with atypical neuroleptics perform comparably to controls in alertness tasks requiring maintenance of vigilance and accurate responses. Further confirmation of this result is needed in an extended sample.

The results of the CRT task contrast with some of those observed in previous studies. Indeed, slower RTs have been found in patients with persistent illness (Baxter and Liddle, 1998) and in patients with fluctuating symptoms and bad general functioning (i.e. with a GAF score <50) (Ngan and Liddle, 2000). A recent study has also shown slower RT in poor responder medicated patients who had a Total PANSS score of 93 ± 17 (Rollnik et al., 2002). Contrasting with this previous study, the patients studied here had a Total PANSS score of 63.8 and a mean GAF score of 51.2 (± 18), indicating that they have few active symptoms and that their day-to-day functioning is rather good. This suggests that current symptoms may be correlated to performance in alertness tasks requiring decision-making processes such as those needed in the CRT task.

Studies in medicated schizophrenic patients suggested that antipsychotic treatments had little effect on RT performance. Rollnik et al. (2002) have shown that medicated patients (conventional and atypical neuroleptics) had significantly longer RT than healthy controls in a CRT task, with no difference between the two types of neuroleptics. Another study has shown that naive patients did not improve their RT after 8 wk of risperidone (7 ± 4 mg/d) (Hong et al., 2002). Risperidone is known to induce extra-pyramidal side-effects at 5–6 mg/d (Weiser et al., 2000). In those studies, the presence of EPS could have interfered with those tasks requiring fast motor responses. Our group of patients was carefully selected to have low EPS scores and low dosages of atypical antipsychotics.

One of the most significant results from the cued detection task is that in terms of RT, patients can be compared to healthy controls. Indeed, RTs to the five types of conditions did not differ between the two groups. Carter et al. (1992) also found that both schizophrenic patients and healthy controls were able to use valid cues to improve their performance, with normal engagement of attention. Positive Alertness Index (double minus no-cue condition) present also in both groups confirms the preserved ability to use the warning signal to sustain their attention already demonstrated with the CRT task. Moreover, patients and controls exhibit comparable spatial index, showing that they were not disturbed by the spatiality of the target.

After calculating benefit and costs induced by the valid and invalid cues, both groups exhibited an attentional benefit, suggesting that when compared to the neutral cue (i.e. double cue) the valid cue improved RTs. However, both groups differed in terms of attentional cost. The disadvantage induced by invalid cues was more pronounced for schizophrenic patients, suggesting that they had difficulty in disengaging their attention in the event of invalidly cued trials. This result is in keeping with previous studies showing a disengagement deficit in medicated schizophrenic patients (Posner et al., 1988; Strauss et al., 1991). The disengagement deficit observed may be due to illness as well as to antipsychotic treatment. This question cannot be clearly answered in this study as there is no comparison with untreated patients. However, Carter et al. (1992) observed a disengagement deficit with untreated patients.

Another important result is that medicated schizophrenic patients, like controls, showed symmetrical covert orienting when targets were displayed in the validly or invalidly cued location. Thus, our result does not replicate the lateralized asymmetry initially

observed in schizophrenics by Posner et al. (1988) and Potkin et al. (1989). In these studies, the asymmetry was only seen in acutely ill patients and not patients in a remitted state. Posner proposed that the asymmetry was linked to auditory hallucinations which occurred at the florid stage of illness. On the other hand, the absence of asymmetry is consistent with some earlier research carried out on schizophrenic patients receiving conventional neuroleptics (Maruff et al., 1995; Nestor et al., 1992; Strauss et al., 1991). Finally Carter et al. (1992) demonstrated that the lateralization of the disengagement deficit could depend on the type of orienting task used, an exogenous task as was the task selected in Posner et al.'s study (1988) or an endogenous task differing by the ratio valid/invalid trials inducing a probable appearance of the target in the valid location.

fMRI studies have shown that there is close similarity between alerting and orienting networks (Achten et al., 1999; Sturm and Willmes, 2001). Specific areas such as the thalamus and the striatum (Corbetta et al., 2000), the dorsolateral prefrontal cortex (Coull, 1998) and the superior colliculus (Robinson and Kertzman, 1995) are activated at different stages of pre-attentive mechanisms. In addition to the areas involved in the alertness tasks, visual orienting tasks induce an activation of the posterior parietal lobe, which is known to be involved in the disengagement of attention (Achten et al., 1999; Corbetta et al., 1993). This finding was confirmed by Steinmetz and Constantinidis (1995) in a study using lesions of the posterior parietal cortex in humans and monkeys. Our results confirm a disengagement deficit in schizophrenic patients resembling the one noted in patients with parietal lesions (Posner et al., 1984). The parietal lobe also appears to support anticipatory response planning by processing mechanisms required for the spatial organization of behavioural responses (Quintana et al., 2003).

Certain methodological limitations need to be addressed. The first limitation concerns the small sample size. The selection criteria were very strict (treatment using monotherapy of neuroleptics, low EPS scores, absence of substance intake, etc.) and therefore reduced the number of candidates who were eligible for the study. The small size of the sample may induce a lower statistical power. This is the reason why care must be taken in the interpretation of our results. Secondly, patients and controls were comparable in terms of study level but not in terms of total IQ. Low total IQ score is a typical feature of medicated schizophrenic patients (Kremen et al., 2001; Meltzer and McGurk, 1999). Thirdly, the durations of antipsychotic treatment were heterogenous. For some patients we cannot exclude that longer duration would have induced additional changes given the fact that some authors reported that cognitive improvement occurs gradually over a period of 1 yr (Purdon et al., 2000).

Despite these limitations, the present results suggest that atypical neuroleptics have a differential pattern of activity on attentional tasks between phasic alertness and visual orienting. In particular, they do not impair basic mechanisms such as phasic alertness. Indeed, visual orienting is specifically impaired in conditions of disengagement in patients with atypical neuroleptics, as shown by a larger attentional cost. It is noticeable that atypical as well as classical antipsychotics do not seem to influence this deficit. This may have consequences on the readiness to react to unexpected events when schizophrenic patients are faced with their natural environment. By contrast RTs in patients were found to be similar to controls in CRT tasks while longer RTs were repeatedly reported in untreated patients and in patients receiving conventional neuroleptics. This could suggest that atypical antipsychotics have a beneficial effect on alertness. Further studies are warranted to replicate these results including a group of untreated patients.

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Statement of Interest

None.

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