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Facial affect recognition in pre-lingually deaf people with schizophrenia

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Abstract

The present study examined facial affect recognition in pre-lingually deaf individuals with schizophrenia. Affective facial-labeling task and the control task of face feature processing (the Benton facial recognition test) were performed by deaf subjects with schizophrenia using French sign language (FSL), hearing subjects with schizophrenia, and hearing healthy controls. Deaf subjects with schizophrenia performed more poorly than hearing clinical controls with schizophrenia or healthy controls on the affective facial-labeling task. No differences were found on the control task between deaf subjects with schizophrenia and hearing clinical or healthy controls. The results showed that facial affect recognition and face feature processing were differently impaired in pre-lingually deaf individuals with schizophrenia, suggesting that neurocognitive backgrounds of impaired affective facial processing may be distinct from those of general impairment in face processing.

Keywords: Face recognition; Facial affect; Pre-lingual deaf; Sign language; Schizophrenia

1. Introduction

Schizophrenia occurs in pre-lingually deaf individuals with probably the same frequency as in the hearing population (Altshuler and Rainer, 1958; Altshuler and Sarlin, 1963; Cooper, 1976). Clinical manifestations of deaf patients with schizophrenia were broadly comparable to those of hearing population with schizophrenia, including language-related symptoms such as auditory hallucination (du Feu and Mckenna, 1999; Quérel, 2000) or thought disorder (Thacker, 1994).

Recent reports noted impaired facial affect recognition in schizophrenia (Mueser et al., 1996; Kohler et al., 2000; Edwards et al., 2001). The impairment was found across the different stages of illness (Addington and Addington, 1998) or different cultural backgrounds (Habel et al., 2000). However, no study investigated facial affect recognition in pre-lingually deaf subjects with schizophrenia.

Modern sign linguists have shown that the face can function to mark lexical, morphological, and grammat-

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ical structures. Deaf signers use facial expressions not only for non-verbal, affective communication, but also for communicating verbal information (Stokoe, 1976; Girod and Vourc'h, 1990). Recent studies exploring face processing in deaf signers (Corina, 1989; Corina et al., 1999) suggested that facial expressions were encoded in different neural systems; those underlying verbal processing and those subserve affective recognition. Moreover, a lesion study revealed that an agrammatical deaf sign-aphasic showed the full range of communicative facial expressions without sign, but showed very diminished use of facial actions in sign (Kegl and Poizner, 1996). Therefore, it is of our great interest to investigate how face recognition is impaired in pre-lingually deaf patients with schizophrenia.

Thus, the present study examined affective face processing in deaf patients with schizophrenia whose first language is French sign language (FSL). The control task of face feature processing was also conducted. It is known that face feature processing is enhanced in deaf population, probably due to the experience of sign language processing (Bettger et al., 1997; McCullough and Emmorey, 1997). Therefore, we hypothesized that affective facial processing and face feature processing are differently impaired in deaf patients with schizophrenia.

2. Method

2.1. Subjects

Fourteen consecutive deaf subjects with schizophrenia who visited the special care unit for deaf individuals with psychiatric disorders in the Centre Hospitalier Sainte Anne between November, 2000 and June, 2001 were recruited. Loss of their hearing ability before 2 years old was confirmed in medical records and their mother tongue was FSL.

Among 14 patients, 3 patients were excluded: 1 patient with a history of head trauma and 2 patients who had problems in French language comprehension (see Procedures). Consequently, 11 patients were selected for face recognition assessments. Diagnosis of schizophrenia applying ICD-10 criteria was confirmed by psychiatrists (C.Q., J.L., and M.F.L.) who were specialists in psychiatric interviewing using FSL. In accordance with previous reports (Evens and Elliot, 1981; Denmark, 1994; Thacker, 1994; du Feu and Mckenna, 1999; Quérel, 2000), deaf patients had symptoms typical in schizophrenia, including auditory hallucination, thought insertion, or bizarre delusions. They were treated with risperidone ($N=6$, range 2–6 mg), oranzapine ($N=3$, range 7.5–20 mg), haloperidol ($N=1$, 6 mg) or amisulpiride ($N=1$, 1200 mg) in outpatient clinic. Their social functioning was moderate to good: three patients have profession such as computer engineer or sign language interpreter, two were student, and six engaged in day-care activity.

The disease control group consisted of 14 hearing subjects who met the ICD-10 criteria of schizophrenia. Ten were consecutive consenting in-patient admissions to a psychiatric unit in the Centre Hospitalier Sainte Anne. Four were recruited from outpatient clinic of the Centre Hospitalier Sainte Anne. They were treated with risperidone ($N=4$, range 4–6 mg), oranzapine ($N=4$, range 10–20 mg), clozapine ($N=1$, 900 mg), haloperidol ($N=4$, range 10–35 mg) or amisulpiride ($N=1$, 800 mg). Healthy control group consisted of 10 hearing volunteers of medical staff in the Centre Hospitalier Sainte Anne. To each subject, the procedure was explained and informed consent was obtained. For deaf signers, the procedure was explained fully in FSL.

2.2. Measures

2.2.1. Affective facial-labeling task

The stimuli used in this study were 48 photographs of faces presenting standardized poses of fundamental emotions. These stimuli included eight examples of each of the six facial expressions (anger, happiness, sadness, fear, disgust, and surprise) developed by Ekman and Friesen (1976) and Matsumoto and Ekman (1988). The factors of gender and race were counter balanced. Consistent with the study of Rapcsak et al. (2000), a facial-labeling task was constructed from these stimuli. Subjects were asked to point to the word that best described the emotion shown in each photograph from the list of six possible emotions.

2.2.2. Control task (the Benton facial recognition test)

The Benton facial recognition test (13-item short form) was included to investigate facial feature processing (Benton et al., 1978). This test requires matching a target face with up to three pictures of the same person presented in a six-stimulus array of faces. It was reported that pre-lingually deaf subjects were experts on this task (Bettger et al., 1997; McCullough and Emmorey, 1997).

2.2.3. Procedures

For deaf subjects with schizophrenia, interviews in FSL were conducted to assess general comprehension and understanding of six emotional labels written in French, and two subjects who had difficulties in recognizing them were excluded from further assessments. The rest of deaf subjects were fluent in FSL, and the level of comprehension was assessed to be good.

The affective facial-labeling task and the control task were completed when the subjects were stabile enough to participate in the assessments. Subjects viewed the pictures in a quiet testing room. The presentation of the faces on a display in randomized order was controlled by a personal computer using SuperLab (Cedrus) software. There were no time limits and no feedback was provided about performance during testing.

3. Results

3.1. Demographics

The three groups were not significantly different in age and gender. The hearing healthy control group had significantly more years of education than the deaf schizophrenia group. The two patient groups were not different in disease duration or onset age. These results are presented in Table 1.

Table 1
Demographic characteristics of the patient and control groups

	Deaf schizophrenia	Hearing schizophrenia	Healthy controls	
Age	26.36 (3.35)	30.71 (8.14)	32.40 (8.07)	NS
Sex				NS
male	5	7	4	
female	6	7	6	
Years of education	10.38 (4.10)	12.63 (2.77)	14.20 (2.10)	$F = 4.335$ (2.32)*
Duration of disease	14 (8.79)	11 (6.45)	–	NS
Age of onset	20.80 (4.21)	21.93 (4.25)	–	NS

* The hearing healthy control group had significantly more years of education than the deaf schizophrenia group: $p < 0.05$ (Bonferroni post hoc tests).

Table 2
Means and standard deviations for facial recognition tasks across the three groups

	Deaf schizophrenia	Hearing schizophrenia	Healthy control
Affective facial labeling task	32.8 (4.94)*	37.86 (5.45)**	43.30 (2.26)
The Benton facial recognition test	21.70 (3.71)	20.21 (3.89)**	23.90 (2.64)

* Significantly different from both the hearing schizophrenia and healthy control group: $p < 0.05$ for hearing schizophrenia and $p < 0.001$ for healthy control.

** Significantly different from healthy control: $p < 0.05$.

3.2. Differences between groups on the facial cognition tasks

The three groups were compared on the total number of correct response in the two tasks. One deaf patient did not perform the control task and the number of deaf patient is 10 in the following analysis. A 1 factor (groups: deaf schizophrenia, hearing schizophrenia, healthy control) repeated measures multivariate analysis of variance MANOVA was conducted. Group was the between-subjects factor and task was the measure. The group main effect was significant [$F(4,60) = 7.074$; $p < 0.001$], suggesting that the three groups differed in their performance across the tasks. Bonferroni post hoc tests were completed and the results of these tests are presented in Table 2. Deaf subjects with schizophrenia performed significantly more poorly on the affective facial-labeling task than either of the control groups. In contrast, they did not differ from either of the control groups on the control task. Hearing schizophrenia group performed significantly more poorly on both tasks than healthy controls.

3.3. Correlation between the measures of the affective facial-labeling task and the Benton facial recognition test

An examination of the correlation shows that for deaf subjects with schizophrenia and hearing healthy

Table 3
Correlation between the measures of affective facial labeling task and the Benton facial recognition test

Deaf schizophrenia	Hearing schizophrenia	Healthy control
0.09	0.61*	0.30

* $p < 0.05$ (Pearson correlation).

subjects, there was no association between performance on the affective facial-labeling task and the Benton facial recognition test. For the hearing schizophrenic subjects, there was a significant association between both tasks. These results are presented in Table 3.

3.4. Differential deficit across emotional categories

Affective facial labeling performance in the six emotional categories is presented in Table 4. A 3 (groups: deaf schizophrenia, hearing schizophrenia, healthy control) × 6 (emotions: anger, disgust, fear, happiness, sadness, surprise) repeated measure analysis of variance (ANOVA) revealed group [$F(2,32) = 13.863$; $p < 0.001$] and emotion type [$F(5,160) = 20.907$; $p < 0.001$] main effects and an interaction [$F(5,160) = 2.186$; $p < 0.05$].

Bonferroni post hoc tests indicated that hearing subjects with schizophrenia were impaired relative to healthy control subjects in recognizing fear ($p < 0.05$). In contrast, deaf subjects with schizophrenia were impaired relative to healthy control subjects in recognizing anger ($p < 0.05$), disgust ($p < 0.05$), fear ($p < 0.05$), and surprise ($p < 0.001$). They were also impaired relative to hearing subjects with schizophrenia in recognizing anger ($p < 0.05$) and surprise ($p < 0.01$).

4. Discussion

Deaf subjects with schizophrenia performed more poorly compared with hearing subjects with schizophrenia in identifying affective facial expressions. On the face feature processing task, significant difference was found only between hearing patients with schizophrenia and healthy controls. In hearing patients, significant correlation was found between the performance of affective face recognition and that of the Benton facial recognition test, which is in accordance with the previous studies (Kerr and Neale, 1993; Addington and Addington, 1998). In contrast, in deaf schizophrenia group, no correlation was found between these two tasks. In accordance with our hypothesis, affective face processing and face feature processing are differently impaired in deaf patients with schizophrenia. These findings have direct impact on psychosocial treatment of deaf patients with schizophrenia.

Differential deficits across six emotional categories were found between groups. In accordance with a previous report (Edwards et al., 2001), both schizophrenia groups performed more poorly on fear recognition compared to healthy controls. To our interest, deaf schizophrenia patients performed more poorly on anger or surprise recognition compared with hearing schizophrenia patients. The selective impairments on anger or surprise recognition cannot be explained by decline of intelligence or general impairment of face perception. Rather, the deficit may be attributed to the dysfunction of deaf signer's neurocognitive systems underlying face recognition, possibly caused by schizophrenia pathology.

Although the present study did not include healthy deaf controls, several studies investigated facial affect recognition in deaf subjects. Campbell et al. (1999)

Table 4
Differential deficit across six emotional categories in the three groups

	Anger	Disgust	Fear	Happiness	Sadness	Surprise
Deaf schizophrenia	4.00 (2.45)*	5.09 (2.39)**	4.09 (1.76)**	7.73 (0.65)	6.27 (1.01)	5.73 (1.79)*
Hearing schizophrenia	6.21 (1.72)	5.79 (2.26)	3.93 (2.06)**	7.86 (0.36)	6.79 (1.58)	7.29 (0.83)
Healthy control	6.30 (1.25)	7.60 (0.70)	6.10 (1.37)	8.00 (0)	7.30 (1.06)	8.00 (0)

* Significantly different from both hearing schizophrenia group (anger, $p < 0.05$; surprise, $p < 0.01$) and healthy control group (anger, $p < 0.05$; surprise, $p < 0.001$).

** Significantly different from healthy control group (disgust, $p < 0.05$; fear, $p < 0.05$).

showed that a facial-display continuum between "surprise" and "puzzlement" was perceived categorically by deaf and hearing subjects. The results suggested that neither deafness nor learning sign reconfigures the mental space where the expressions "surprise" and "puzzlement" are processed. On the other hand, studies using a lateralized recognition accuracy test revealed that functional hemispheric specialization of affective face recognition is influenced by the experience of using sign language. Szelag and Wasilewski (1992) showed that the right hemisphere dominance in affective face recognition was observed in hearing subjects, and not in deaf subjects. Corina (1989) investigated the use of two types of facial expressions, linguistic and affective, in hearing and deaf subjects. Hearing subjects showed right hemisphere dominance for both type of signals while deaf subject's hemispheric dominance was greatly influenced by the order of presentation. No differences were found as to accuracy rate across groups. The results suggested that, for deaf signers, lateralization of facial expression recognition is influenced by the context: whether facial expressions represent affective valences or linguistic information. Taken these findings together, it is highly possible that the neuromodulation for face processing found in healthy signers is impaired in the signers with schizophrenia in the present study, which may explain the differential deficit of facial affect recognition.

Due to relative difficulties in the diagnosis of deaf psychotic patients and small sample size, the present results should be interpreted with caution. Further studies, especially neuroimaging ones, are needed to explore neurocognitive mechanisms of facial affect recognition in deaf individuals with schizophrenia.

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