Facial Expression in Schizophrenia

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Introduction

Recent empirical studies have found that schizophrenics exhibit diminished observable facial expressivity in response to emotional stimuli (e.g., Berenbaum and Oltmanns 1992; Kring et al 1993; Kring and Neale 1996) yet report experiencing similar levels of emotion as their normal counterparts; however, it remains unclear whether schizophrenics are completely unexpressive, or if they exhibit more subtle, unobservable facial muscle activity that cannot be seen by observers. Additionally, the diminished facial expressiveness found in schizophrenia may be a function of affective flattening, a side effect of medication (akinesia), or both (Blanchard and Neale 1992).

The present study sought to extend previous findings of emotional responding in schizophrenics in two ways. First, because schizophrenics exhibit very little observable facial expressivity, a more sensitive measure of facial expression, facial electromyographic (EMG) activity, was recorded during the presentation of emotional films. Second, to examine more closely the effects of medication on facial expressivity, a within subjects design was employed such that all patients were tested at two time points (approximately six months apart): when they were taking neuroleptic medication and when they were medication free. The present article presents preliminary results from an ongoing longitudinal study of affective response in schizophrenia.

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Methods

Subjects

Subjects were seven male schizophrenic patients and two male schizoaffective patients from the Nashville Veterans Administration Medical Center. Patients met the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association 1994) criteria for a diagnosis of schizophrenia or schizoaffective disorder as determined by the Structured Clinical Interview for DSM-IV—Patient Version (SCID-P; First et al 1994). Patients were excluded from the study if they had tardive dyskinesia or a history of seizures, head injury, or neurological disorder. All patients were tested twice: once when they were medication free (mean days drug free = 28.22, SD = 26.46) and again when they were taking neuroleptics. Six of the patients were unmedicated at the time-one testing, and three of the patients were unmedicated at the time-two testing. Patients were either withdrawn from medication by their treating psychiatrist or were medication free when contacted about participating in the study. Five subjects were inpatients at one testing session and outpatients at the other testing session. Four subjects were outpatients at both testing sessions. Demographic and clinical information for the patients is presented in Table 1.

Psychophysiological Recording

EMG activity was recorded from the left zygomatic and corrugator muscle regions. EMG signals were relayed through shielded cable to a Coulbourn Instruments (Allentown, PA) bioamplifier (S75-01) and band-pass filtered, with a low cutoff of 8 Hz and a high cutoff of 250 Hz. Signals were then rectified and smoothed with a Coulbourn contour-following integrator (S76-01) with a time constant of 20 ms. The amplified, integrated EMG signals were transmitted online to a computer, and each of

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Table 1. Demographic and Clinical Information

Characteristic	M	SD
Age	38.89	8.36
Education	11.67	2.18
Time between testing sessions (in days)	177.22	67.28
Number of previous hospitalizations	10.22	11.66
Daily neuroleptic dose (in CPZ equivalents)	780.4	993.6
Race		
Caucasian	5	
African-American	4	
Marital Status		
Single	2	
Married	1	
Divorced	5	
Separated	1	
Neuroleptic medications		
Chlorpromazine	1	
Clozapine	1	
Fluphenazine	3	
Thiothixene	1	
Trifluoperazine	2	
Anticholinergic medications		
Benztropine	4	
None	5	

the two EMG channels (zygomatic, corrugator) was digitized with Coulbourn software at a rate of 100 samples per second and stored for later analysis. Two subjects' EMG data were not used in the analysis due to high initial impedance values at the Time-one testing.

Procedure

The procedure for both testing sessions was identical. EMG activity was recorded during a five-minute baseline period, and then a semistructured interview was conducted and later rated for flat affect using a modified version of the Affective Flattening subscale of the scale for the assessment of negative symptoms (SANS; Andreasen 1982). In this assessment, six items (unchanging facial expression, decreased spontaneous movements, paucity of expressive gestures, poor eye contact, affective nonresponsivity, and lack of vocal inflections) were rated for severity on a scale from 0 to 5. Ratings for each patient's two testing sessions were conducted by different pairs of raters, and the raters were blind to medication status.

EMG activity was recorded, and subjects were unobtrusively videotaped as they viewed positive and negative emotional films from one of two stimulus tapes (randomly assigned). The film clips included excerpts from contemporary movies that have previously been shown to be successful in eliciting the intended emotion in schizophrenic patients (Berenbaum and Oltmanns 1992; Kring et al 1993; Kring and Neale 1996). Subjects viewed different films for the two testing sessions. Subjects' videotaped facial expressions were later coded using the facial expression coding system (FACES; Kring and Sloan 1991), and coders were blind to both medication status and SANS ratings.

Results

SANS ratings of flat affect from the interview did not differ across the two testing sessions. The patients exhibited similar levels of flat affect when they were not taking medication ($M = 7.17$, SD = 4.37) and when they were taking medication ($M = 9.50$, SD = 2.95), $t(8) = 1.55$, ns. It is interesting to note that patients were rated as slightly more flat when taking medication, yet the variability in these ratings was greater when patients were off medication.

Similar to previous studies, patients exhibited little observable facial expression (see Table 2). Mean duration of expressions was the dependent variable in a repeated measures multivariate analysis of variance (MANOVA) with medication (on, off) and film (positive, negative) as within subjects factors. For both positive and negative mean duration, neither the medication nor the medication × film interaction effects were significant, suggesting that medication did not affect observable facial expression. The film main effect was significant for mean positive duration, $F(1,8) = 11.30$, $p < 0.01$, indicating that mean positive duration was greater during the positive films than negative films.[1] The film main effect for mean negative duration was not significant. Only two of the nine patients exhibited any negative expressions in response to negative films when medicated, and only four of the nine patients exhibited any negative expressions in response to negative films when unmedicated. In contrast, seven of the nine patients exhibited positive expressions in response to positive films when medicated, and eight of the nine patients exhibited positive expressions in response to positive films when unmedicated.

A multivariate analysis of covariance (MANCOVA) was conducted separately for corrugator and zygomatic activity. Baseline levels of corrugator and zygomatic EMG activity served as the covariates for the corrugator and zygomatic analyses, respectively. These analyses revealed a similar pattern of results: neither the medication nor medication × film interaction effects were significant, suggesting that medication did not affect EMG activity. The film main effects were significant, however. Specifically, patients evidenced greater corrugator activity in response to the negative films than in response to the positive films ($F(1,6) = 16.36$, $p < 0.01$). Similarly for zygomatic activity, the difference between the positive and negative films approached significance ($F(1,6) = 4.96$, $p < 0.07$), indicating that patients had somewhat greater zygomatic activity in response to the positive films than to the negative films (see Table 2).

Discussion

In this study, facial expression was examined comprehensively, using measures of observable and unobservable (EMG) facial responses to emotional film clips, as well as ratings of flat affect based on an interview. Across these measures, facial expressivity did not appear to be affected by neuroleptic medication. That is, there were no significant changes in observable or unobservable

[1] Patients exhibited very little positive expressivity during both the positive (around 3 seconds) and negative (around 1 second) films. Each of the films lasted approximately 300 seconds.

Table 2. Descriptive Statistics for Observable Facial Expression and EMG

	Film			
	Positive		Negative	
	U	M	U	M
Mean duration of positive expressions	3.14 (2.23)	3.41 (2.84)	1.00 (2.00)	0.67 (1.52)
Mean duration of negative expressions	0.56 (1.33)	0.78 (1.56)	2.09 (3.49)	3.47 (9.60)
Zygomatic activity	5.32 (3.84)	4.93 (5.25)	2.12 (1.94)	1.97 (1.08)
Corrugator activity	9.38 (13.96)	11.87 (9.62)	13.14 (13.78)	14.13 (9.85)

Tabled values are means; standard deviations in parentheses. Mean duration values are in seconds and were computed by dividing the total duration by the number of expressions for the films. Zygomatic and corrugator values are in microvolts. U = patients when unmedicated. M = patients when medicated.

expressiveness or in SANS ratings of flat affect as a function of medication status.

These findings are consistent with a number of other studies that have found flat affect to be particularly unresponsive to medication (e.g., Angrist et al 1980; Johnstone et al 1978; Meltzer 1991). This study extends previous findings by suggesting that both observable positive and negative facial expression are relatively unaffected by medication. Also, when positive and negative facial expression were assessed using a more sensitive measure (EMG), medication was still found to have no significant effect. In addition, the data suggest that diminished facial expression is stable over time and thus is a relatively chronic feature of schizophrenia.

While the patients showed little outwardly observable facial expression, they still exhibited greater zygomatic activity in response to positive films than negative films and greater corrugator activity in response to negative films than positive films. These findings suggest that schizophrenics are responding facially to the emotional stimuli. Using EMG in comprehensive assessments of facial expressiveness in schizophrenia seems to be warranted because EMG allows for the detection of responsiveness (e.g., negative expressiveness) to emotional stimuli not evident with observable facial expression and is sensitive to subtle expressions, which may characterize most of schizophrenic patients' facial responses.

It is important to acknowledge that the present study is limited by the small sample size and the lack of a normal comparison group. Indeed, these are preliminary results, and conclusions must remain tentative. The failure to find a significant medication effect could possibly be the result of relatively low power in the analyses. It is interesting to note, however, that for most measures, patients were more expressive when taking medication than when not taking medication. In addition, the sample was limited to male patients, and thus it is unclear whether female patients would exhibit a similar pattern of emotional responding. Further, although different films were used for each testing session and the average time between testing sessions was several months, practice effects cannot be ruled out when using a within-subjects design. More data are currently being collected on the emotional responding of both schizophrenic and normal subjects to bolster these findings.

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