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Static posed and evoked facial expressions of emotions in schizophrenia

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Abstract

Objective: Impaired facial expressions of emotions have been described as characteristic symptoms of schizophrenia. Differences regarding individual facial muscle changes associated with specific emotions in posed and evoked expressions remain unclear. This study examined static facial expressions of emotions for evidence of flattened and inappropriate affect in persons with stable schizophrenia.
Methods: 12 persons with stable schizophrenia and matched healthy controls underwent a standardized procedure for posed and evoked facial expressions of five universal emotions, including happy, sad, anger, fear, and disgust expressions, at three intensity levels. Subjects completed self-ratings of their emotion experience. Certified raters coded images of facial expressions for presence of action units (AUs) according to the Facial Action Coding System. Logistic regression analyses were used to examine differences in the presence of AUs and emotion experience ratings by diagnosis, condition and intensity of expression.
Results: Patient and control groups experienced similar intensities of emotions, however, the difference between posed and evoked emotions was less pronounced in patients. Differences in expression of frequent and infrequent AUs support clinical observations of flattened and inappropriate affect in schizophrenia. Specific differences involve the Duchenne smile for happy expressions and decreased furrowed brows in all negative emotion expressions in schizophrenia.
Conclusion: While patterns of facial expressions were similar between groups, general and emotion specific differences support the concept of impaired facial expressions in schizophrenia. Expression of emotions in schizophrenia could not be explained by impaired experience. Future directions may include automated measurement, remediation of expressions and early detection of schizophrenia.

Keywords: Emotion expression; Schizophrenia; Facial Action Coding System; Affective flattening; Inappropriate affect

1. Introduction

Facial expressions are shared in humans and animals, and are central for communication both within and across species (Darwin, 1872). Abnormal expressions of emotions have been described as characteristic symptoms of schizophrenia (Andreasen, 1984a; Bleuler, 1911) and may precede the onset of illness by many years (Walker et al., 1993). Affective flattening and other negative symptoms are present at onset of illness (Gelber et al., 2004; Shtasel et al., 1992) more common in males, increase with illness duration (Shtasel et al., 1992) and appear distinct from depression (Kohler et al.,

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1998). In contrast to positive symptoms of schizophrenia, negative symptoms may not respond as well to antipsychotics and have been linked to impairment in psychosocial functioning (Edwards et al., 1999; Ho et al., 1998).

Whereas there are widely used and validated instruments that measure and parse aspects of cognitive dysfunction and its neurobiology in schizophrenia, clinical assessments of affective flattening and other negative symptoms have been limited to observer based rating scales. The ability to quantify emotional expression, especially in the face, has been enhanced by work aimed at measuring unique features of universal emotions. Six universal emotions are recognized across cultures in facial expressions — happiness, sadness, anger, fear, disgust and surprise (Eibl-Eibesfeldt, 1970; Ekman and Friesen, 1975; Izard, 1994). Based on facial muscle movement, Ekman and Friesen (1978) developed the Facial Action Coding System (FACS), which identifies discrete facial muscle movements, called Action Units (AUs). FACS has been simplified and adapted for clinical research. Emotion FACS (EMFACS: Friesen, 1986) identifies AUs associated with the predicted expression of the particular emotion, and the Facial Expression Coding System (FACES: Kring et al., 1993; Kring and Sloan, 2007), which rates overall dynamic facial changes, according to number of expressions, intensity and duration.

Examinations of facial expressions beyond clinical rating scales in schizophrenia have reported on imitative expressions (Putnam and Kring, 2007; Schwartz et al., 2006; Tremeau et al., 2005), deliberate or posed expressions (Berenbaum, 1992; Schwartz et al., 2006; Tremeau et al., 2005), spontaneous expressions within dyadic interactions (Aghevli et al., 2003; Mattes et al., 1995; Schneider et al., 1990; Steimer-Krause et al., 1990), expressions associated with emotional film clips ((Berenbaum and Oltmanns, 1992; Earnst et al., 1996; Kring et al., 1999, 1993) or emotional experiences of the participants (Berenbaum and Oltmanns, 1992; Gottheil et al., 1970; Kring et al., 1993; Tremeau et al., 2005). Media for capturing facial expressions have included still photographs (Gottheil et al., 1976; Schwartz et al., 2006), videotapes (Aghevli et al., 2003; Berenbaum, 1992; Berenbaum and Oltmanns, 1992; Gaebel and Wolwer, 2004; Kring et al., 1993; Putnam and Kring, 2007; Steimer-Krause et al., 1990; Tremeau et al., 2005), and electromyographic recordings (Earnst et al., 1996; Kring et al., 1999; Mattes et al., 1995). Videotaped acquisition offers the advantage of capturing duration and frequency of emotion expressions. However, analyses of such lengthy data sets have been limited to global assessment of positive and negative emotion expressions, rather than changes in specific face regions. Other measurements of emotion expressions have included recognition rates of expressions (Gottheil et al., 1970, 1976; Putnam and Kring, 2007; Schneider et al., 1990; Schwartz et al., 2006) and FACS derived measures without analysis of specific AUs (Aghevli et al., 2003; Berenbaum, 1992; Berenbaum and Oltmanns, 1992; Gaebel and Wolwer, 2004; Kring et al., 1993; Tremeau et al., 2005). In addition, automated methods have included computerized face morphometry (Mattes et al., 1995; Schneider et al., 1990) and electromyographic measurements (Earnst et al., 1996; Kring et al., 1999; Mattes et al., 1995) that can measure minute muscle activations, albeit limited to select face regions.

Most studies have supported affective flattening in general, rather than inappropriate affect. Studies that examined specific emotions reported on selective impairment in happy (Gottheil et al., 1976), sad(Putnam and Kring, 2007), angry (Gottheil et al., 1970; Schwartz et al., 2006) and disgusted (Schwartz et al., 2006) expressions. Laterality differences of emotional expressions have not been reported, although acuity of illness may be associated with differential impairment in upper versus lower face expressions (Gaebel and Wolwer, 2004; Mattes et al., 1995; Schneider et al., 1990). While affective flattening is considered characteristic of schizophrenia, comparisons with psychiatric (Berenbaum, 1992; Gaebel and Wolwer, 2004; Schneider et al., 1990; Tremeau et al., 2005) and medical (Steimer-Krause et al., 1990) control groups have raised questions regarding specificity.

Antipsychotics, particularly first-generation, are associated with extrapyramidal symptoms, but their influence on emotion expression remains unclear. Some studies indicated an adverse effect of medications on facial expression (Gaebel and Wolwer, 2004; Schneider et al., 1992). Others (Earnst et al., 1996; Putnam and Kring, 2007; Tremeau et al., 2005) examined patients both on and off antipsychotics and found no clear effect on expressivity.

Previously, we investigated AUs in high intensity evoked expressions of universal emotions expressed by actors and determined AUs, which were essential for accurate recognition and increased recognition, when present in combinations (Kohler et al., 2004). The aim of the present study was to extend previous investigations on evidence of impaired affect in schizophrenia and to examine individual muscle movements in static facial expressions of emotions in persons with stable symptoms. We expected persons with schizophrenia to