A structural MRI study of excoriation (skin-picking) disorder and its relationship to clinical severity

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ABSTRACT

Excoriation (skin-picking) disorder (SPD) shares symptomology with other obsessive-compulsive and related disorders. Few studies, however, have examined the neurological profile of patients with SPD. This study examined differences in cortical thickness and basal ganglia structural volumes between 20 individuals with SPD and 16 healthy controls using magnetic resonance imaging (MRI). There were no significant differences in demographic variables (age, gender, education and race) between groups. All subjects completed a structural MRI scan and completed a battery of clinical assessments focusing on SPD symptom severity, depression and anxiety symptoms, and quality of life. No statistically significant differences in basal ganglia (caudate, putamen, and nucleus accumbens) structural volumes were found between groups. In individuals with SPD, increasing impulsiveness correlated positively with increased cortical thickness in the left insula, and skin picking severity correlated negatively with cortical thickness in the left supramarginal gyrus and a region encompassing the right inferior parietal, right temporal and right supramarginal gyrus. This study suggests similarities and differences exist in symptomology between SPD and the other obsessive-compulsive and related disorders. Additional neuroimaging research is needed to better delineate the underlying neurobiology of SPD.

1. Introduction

Excoriation (skin-picking) disorder (SPD), also known as dermatillomana, was added to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in the category of ‘Obsessive-Compulsive and Related Disorders’ in 2013 (American Psychiatric Association, 2013). SPD is regarded as a type of body focused repetitive behavior (BFRB), along with hair pulling (trichotillomania) and nail biting, and is characterized by excessive, repeated scratching or picking of the skin leading to tissue damage (Niemeier et al., 2015; Grant et al., 2012; Arnold et al., 1998; Odlaug and Grant, 2008). SPD has an estimated prevalence of 1.2–5.4% in the general population and appears to be more common in women (Monzani et al., 2012; Hayes et al., 2009; Keuthen et al., 2010; Wilhelm et al., 1999). Those with SPD report that the time spent picking can lead to social and work related problems (Flessner and Woods, 2006).

Preliminary studies have explored the role of genetic and environmental influences in SPD pathophysiology. SPD is frequently comorbid with obsessive-compulsive disorder (OCD) (Grant and Stein, 2014; Torres et al., 2016), body dysmorphic disorder (BDD) (Arnold et al., 1998; Grant et al., 2015; Phillips, 2005) and trichotillomania (Grant et al., 2012), and one model proposes that these disorders share a latent liability factor conferring genetic risk to all obsessive-compulsive spectrum disorders (Monzani et al., 2014). SPD has been found to be present across familial generations in case studies (Khumalo et al., 2016). Furthermore, a twin study found genetic factors to account for approximately 40% of variance in skin picking, supporting the hypothesis that genetic vulnerability may lead to more severe symptoms in some patients with SPD (Monzani et al., 2012).

A few studies have sought to examine possible brain abnormalities in people with SPD, in an effort to understand its neurobiology. In one study, Roos and colleagues used structural MRI imaging and found subjects with SPD to have increased ventral striatum volume, increased accumbens volume, reduced right hemisphere cortical thickness in the frontal areas, and increased bilateral thickness of the cuneus when compared to a control population and a trichotillomania group (Roos...
A different study using diffusion tensor imaging found that SPD was associated with significantly reduced fractional anisotropy in white matter tracts, including the anterior cingulate cortices (Grant et al., 2013). In a recent functional MRI (fMRI) study examining 18 patients with SPD compared to a sample of 15 healthy controls, Odlaug and colleagues found functional abnormalities in striatal circuitry and right medial frontal regions when presented with an executive planning task and neural regions associated with habit generation and inhibitory processing (Odlaug et al., 2016). In a prior fMRI study examining those with concurrent daily skin picking and Prader-Willi syndrome, Klubané and colleagues found activation of introceptive, motor, attention and somatosensory processing during skin-picking episodes (Klubané et al., 2015). Additionally, some studies examining cognitive dysfunctions in individuals with SPD have found impaired stop-signal reaction times (i.e. impaired inhibitory control) but intact cognitive flexibility compared to controls (Odlaug et al., 2016; Grant et al., 2011; Snorrason et al., 2011).

Due to the limited data regarding the neurobiology of SPD, this study sought to examine specific structural differences in neuroanatomy between those with SPD and a healthy control group. Based on previous studies, we hypothesized that subjects with SPD would have reduced cortical thickness in frontal cortical regions and increased volumes in basal ganglia structures. Furthermore, we predicted that worse disease severity in SPD would be associated with higher striatum volumes and lower frontal cortical thickness.

2. Experimental proceedings

2.1. Participants

Individuals between the ages of 18 and 65 with a primary current diagnosis of SPD (using criteria that would later be the basis for the DSM-5 criteria) were recruited via newspaper advertisements and referrals. Exclusion criteria included: unstable medical illness, history of seizures, lifetime bipolar disorder, dementia or psychotic disorder, substance disorder within the last 3 months, current suicide risk, and current pregnancy or inadequate contraception in women of childbearing potential. A board certified psychiatrist specializing in obsessive-compulsive disorders assessed patients to confirm the diagnosis. Healthy control participants were recruited via posters, newspaper advertisements and word of mouth. Healthy controls had no lifetime or current diagnosis of a psychiatric disorder.

This was a two-site study with the same principal investigator and identical procedures at each site. Data were collected from November 2010 through April 2012 at the University of Minnesota. Data were collected from November 2014 through February 2015 at the University of Chicago. The institutional review boards at both universities approved this study. Participants provided written informed consent and received financial compensation. This study was carried out according to the principles of the Declaration of Helsinki (World Medical Association, 2013).

2.2. Clinical variables

Severity of skin-picking symptoms was evaluated using the Yale-Brown Obsessive Compulsive Scale modified for Neurotic Excoriation (NE-YBOCS), and the Skin Picking Self Assessment Scale (SP-SAS) (Grant et al., 2007). The NE-YBOCS is a clinician-administered scale of skin picking severity, whereas the SP-SAS is a self-report measure. Both instruments assess severity of SPD symptoms over the past seven days and have total possible scores of 40 and 24 respectively, with higher scores equating to worse symptom severity.

Subjects completed the Quality of Life Inventory (QoLI), a self-administered survey examining the importance and satisfaction of the subject with various parts of their life (Frisch, 2013). Additionally, anxiety and depressive symptoms were evaluated using the Hamilton Anxiety Rating Scale (HAM-A) and the Hamilton Depression Rating Scale (HAM-D), respectively (Hamilton, 1959, 1960).

2.3. Data analysis

Demographic and clinical variables were tabulated and compared between groups using independent t-tests and chi-squared tests as appropriate. Where model assumptions were violated, alternative non-parametric tests were used, as indicated in the text. Statistical tests used IBM SPSS software version 22.

MRI scans were acquired at the University of Chicago using a 3T Philips Achieva Quasar Dual 16 Ch system. MRI scans from the University of Minnesota were also acquired using a 3T machine. Scans comprised T1-weighted images obtained using a spoiled-gradient recall sequence with slice thickness of 2 mm, temporal resolution of 33 ms, echo time of 3 ms, field view of 24 cm, flip angle of 40 degrees, and matrix size of 256 × 256. Brain imaging MRI scans were processed using FreeSurfer v5.3 (www.freesurfer.net). FreeSurfer has been previously validated and explained in detail (Dale et al., 1999; Fischl et al., 1999; Fischl and Dale, 2000). Using automated algorithms, brain data were transformed to standard space, segmented, normalized, and smoothed using a standard 10 mm kernel. Differences in regional cortical thickness were compared between SPD and controls in FreeSurfer (Qdec software) using a voxel-wise significance threshold of p < 0.001 uncorrected (main effect of group). Potential differences in volumes of a priori structures of interest (caudate, putamen, nucleus accumbens) between the groups were explored using t-tests. These regions of interest were selected because they have been implicated in previous neuroimaging work of SPD or the related disorder, trichotillomania. Relationships between symptom severity and brain structure were explored using (i) QDec for cortical regions (voxel-wise threshold of p < 0.001 uncorrected); and (ii) t-tests for the same a priori subcortical regions (p < 0.05 uncorrected). Only regions with a significant correlation at p < 0.001 are described by name.

3. Results

No significant differences existed between individuals with SPD (n = 20) and healthy controls (n = 16) on any demographic variable (Table 1). As expected, we found significant differences in HAM-A (p < 0.001), HAM-D (p < 0.001) and QoLI (p = 0.002) scores between the two groups (Table 2). SPD participant scores on HAM-A and HAM-D, however, were well beneath threshold for clinically significant mood and anxiety disorders. There were no significant differences in cortical thickness between SPD and control groups at p < 0.001 uncorrected; nor did the two groups differ significantly in terms of striatal volumes at

| Table 1 | Demographic variables in skin picking disorder (SPD) subjects and control populations. |
|---|---|---|---|
| SPD subjects | Controls | Statistic | p-value |
| (n = 20) | (n = 16) | | |
| Age (mean, SD) | 29.50 (9.42) | 34.00 (15.58) | t = −1.02 | 0.32 |
| Gender (n, %) | | | | |
| Male | 0 (0%) | 4 (25.0%) | χ² = 3.38 | 0.07* |
| Female | 20 (100%) | 12 (75.0%) | | |
| Education (n, %) | | | | |
| Some college or less | 8 (44.44%) | 4 (25.0%) | χ² = 1.40 | 0.24 |
| College graduate or more | 10 (55.56%) | 12 (75.0%) | | |
| Race (n, %) | | | | |
| Caucasian | 19 (95.0%) | 13 (81.3%) | | |
| Latino/Hispanic | 0 (0%) | 2 (12.5%) | | |
| Asian | 1 (5.0%) | 1 (6.3%) | | |

* = p-value with Yates correction.
^ = Education data missing for 2 subjects in the SPD group.
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