Emotion Regulation Patterns in Adolescents With High-Functioning Autism Spectrum Disorder: Comparison to Typically Developing Adolescents and Association With Psychiatric Symptoms

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Abstract

Autism spectrum disorder (ASD) is often associated with poor emotional control and psychopathology, such as anxiety and depression; however, little is known about the underlying mechanisms. Emotion regulation (ER) is a potential contributing factor, but there has been limited research on ER and its role in comorbid psychopathology in ASD. In this study, we compared self-reported ER with self- and parent reports of psychopathology in 25 high-functioning adolescents with ASD and 23 age- and Intelligence Quotient (IQ)-matched typically developing controls. Contrary to expectations, both groups reported similar levels of adaptive, voluntary forms of ER (problem solving, acceptance, etc.). However, the ASD group reported significantly greater use of involuntary forms of ER that are typically maladaptive, including remaining focused on the stressor (e.g. rumination and emotional arousal) and shutting down (e.g. emotional numbing and being unable to think or act). Associations between ER and psychopathology were generally more robust using self-report rather than parent report. For both groups, greater endorsement of involuntary ER strategies was associated with higher ratings of psychopathology, whereas voluntary ER strategies focused on changing or adapting to the situation were significantly associated with lower levels of psychopathology. The magnitude and direction of association between ER types and psychopathology were similar for measures of depression and anxiety. These findings can help guide the development of psychosocial treatments targeting dysfunctional ER in adolescents with ASD. Interventions focused on ER as a transdiagnostic process may be a more robust method to improve emotional control and decrease emotional distress in ASD than disorder-specific interventions.

Keywords

emotion regulation; psychiatric comorbidity; depression; anxiety; coping

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Introduction

The common comorbidity between autism spectrum disorder (ASD) and other psychiatric conditions is increasingly recognized. As compared with non-ASD individuals, children diagnosed with ASD utilize nearly 12 times more psychiatric services for problems related to anxiety and depression as well as those associated with externalizing behaviors (i.e. aggression, defiance, self-injury, and tantrums) [Croen, Najjar, Ray, Lotspeich, & Bernal, 2006]. Deficits in emotion regulation (ER), or the process of appropriately modifying emotional responses to stressful stimuli, may be an important factor underlying these concerns [Mazefsky et al., 2013].

Elements of ER

ER is considered a critical adaptive mechanism that allows individuals to maintain an optimum level of arousal in order to meet personal and social goals [Chambers, Gullone, & Allen, 2009]. ER is a multi-faceted developmental process, which may be voluntary (e.g. conscious and volitional) or involuntary (e.g. unconscious and automatic) [Mauss, Bunge, & Gross, 2007]. Regulation may result in an increase, decrease, or maintenance of emotion, and it can impact the intensity, duration, or valence of the emotion. When ER is directly related to a stressor or is a long-term response, it is usually considered within the framework of coping. We view coping and both voluntary and involuntary stress responses as all falling under the umbrella of ER, and thus we use the term ER throughout the remainder of the manuscript.

Numerous models of ER have been developed [Skinner, Edge, Altman, & Sherwood, 2003]. To be consistent with our method of measurement, we primarily utilized the theoretical framework developed by Connor-Smith, Compas, Wadsworth, Thomsen, and Saltzman [2000]. In this model (see Fig. 1), emotional responses are divided along two key dimensions: (a) voluntary vs. involuntary; and (b) engagement (aimed directly at the stressor or emotional response) vs. disengagement (aimed away from the stressor or emotional response) [Connor-Smith et al., 2000]. Voluntary engagement is further broken down into strategies to either directly change the stressor or response (primary) or adapt to the situation (secondary).

The balance of involuntary vs. voluntary uses of ER, as well as the sophistication of ER strategies, changes throughout development. In the typically developing (TD) population, ER improves throughout adolescence in concert with increasing development of the prefrontal cortical networks [Zelazo, Qu, & Kesek, 2002]. As children mature, they learn to tolerate a range of social and sensory experiences, modulate arousal, express emotional states in socially appropriate ways, and seek and respond appropriately to outside assistance [Laurent, Otr, & Rubin, 2004]. Although there is variability, ER skills are typically maintained or improve in adulthood [Charles & Carstensen, 2007]. The acquisition of these skills is critical to effective stress management and social adjustment.

ER and Psychopathology

Without effective ER, individuals experience longer and more severe periods of distress, which may predispose them to the development of depression and anxiety [Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006]. A thorough review of this relatively large body of literature can be found in a recent meta-analysis [Aldao, Nolen-Hoeksema, & Schweizer, 2010]. Briefly, in TD individuals, the greater use of voluntary ER strategies, such as problem solving and cognitive restructuring, is protective against a broad range of psychopathology, including both internalizing and externalizing behaviors [Connor-Smith et al., 2000]. Consequently, these voluntary responses can be thought of as primarily adaptive. Conversely, ER responses such as rumination, denial, and avoidance are seen more commonly in those with psychopathology. It should be noted, however, that the various ER strategies do not fall into one of these categories in absolute terms. In addition, the strength of the positive association between maladaptive ER strategies and psychopathology tends to be greater than the negative association between psychopathology and adaptive ER strategies [Aldao et al., 2010].

Numerous therapies, including both dialectical and cognitive behavioral therapies [Beck, 1991; Linehan, 1987], incorporate a focus on decreasing the use of maladaptive ER strategies and emphasize more effective strategies. Recently, therapeutic approaches have emerged that involve targeting ER as a transdiagnostic process, regardless of the specific disorder present [Nolen-Hoeksema & Watkins, 2011]. A review of these approaches found that they appear to be as effective as disorder-specific treatments, resulting in symptom improvement that is superior to wait-list controls [McEvoy, Nathan, & Norton, 2009]. Thus, it is likely that improvements in our understanding of ER can continue to guide the development of clinical therapies.

ER in ASD

Given poorly developed connectivity within the frontal cortex in ASD [Just, Keller, Malave, Kana, & Varma, 2012], one would expect to observe difficulties regarding the development of ER in individuals with ASD. Indeed, clinical accounts suggest the frequent presence of increased negative affect coupled with rapid escalation of significantly impairing and seemingly out-of proportion reactions [Mazefsky & White, 2013]. However, the majority of research on the experience of emotion in ASD has focused on problems with self-awareness and expression of emotions [Capps, Yirmiya, & Sigman, 1992; Rieffe, Meerum Terwogt, & Kotronopoulou, 2007]. Although it has been argued that ER is a critical mechanism for explaining maladaptive emotional responses that may be inherent in ASD as well as a risk for developing comorbid psychiatric disorders [Mazefsky et al., 2013; Mazefsky, Pelphrey, & Dahl, 2012], there have been few empirical investigations of ER in ASD.

Data from two observational studies in ASD provide some preliminary evidence of increased maladaptive ER and decreased or more ineffective use of adaptive strategies. When young children with ASD were presented with a mildly frustrating situation (the removal of a desired toy), they employed fewer adaptive strategies, such as engaging in an alternate activity, and more maladaptive strategies, such as attempting to physically prevent the toy from being taken away [Konstantareas & Stewart, 2006]. In another observational

study that required young children with ASD to solve an unsolvable puzzle, a similar pattern of decreased adaptive and increased maladaptive strategy use was found [Jahromi, Meek, & Ober-Reynolds, 2012]. The children with ASD stopped trying to solve the puzzle earlier than TD children, which was interpreted as them being less effective at decreasing their frustration.

A few recent self-report studies of ER in ASD shed some light on the internal processes behind ER. Children with ASD 9–13 years old reported using fewer voluntary ER strategies than TD children when dealing with common negative life events [Rieffe et al., 2011]. Similarly, adults with ASD reported using voluntary ER approaches, such as cognitive reappraisal, significantly less often and with less self-efficacy than those without ASD [Samson, Huber, & Gross, 2012]. Poor emotional awareness in ASD may impede the effectiveness of voluntary ER [Mazefsky & White, 2013], given that a basic level of insight into one's own emotional state is necessary for the successful implementation of voluntary ER strategies [Lambie & Marcel, 2002].

As with non-ASD populations, patterns of ER may be related to the development of psychopathology. For example, Rieffe et al. [2011] found that maladaptive strategies of catastrophizing and self-blame were positively correlated with depressive symptoms and anxiety for children with and without ASD. Pouw, Rieffe, Stockmann, and Gadow [2013] found fewer depressive symptoms in children with ASD who used either voluntary ER strategies like telling someone what happened and problem solving. They also noted that maladaptive responses such as acting out were associated with more depressive symptoms.

This Study

To our knowledge, there have been no published studies addressing ER in adolescents with ASD. We also know especially little about the rate at which individuals with ASD engage in involuntary ER responses. Therefore, the first aim of this study was to explore patterns of both voluntary and involuntary forms of ER in adolescents with high-functioning ASD. Normative neurobiological and pubertal changes during adolescence are associated with increased emotional reactivity and vulnerability to the emergence of psychopathology [Dahl & Gunnar, 2009], suggesting that adolescence may be a critical developmental window related to ER. Second, we investigated how ER corresponds to manifestations of psycho-pathology in this population, which may help inform prevention and treatment efforts.

Method

Participants

Participants included 25 adolescents with ASD and 23 TD controls. They were community volunteers recruited through newsletters, postings on ASD-related websites, and presentations for parents and professionals. This investigation was part of a study that included neuroimaging. Thus, participants were excluded if they had contraindications for neuroimaging. Advertisements referred to it as a study to learn "how the brain responds to emotions differently in children and teens with ASD." All participants were between the ages of 12 and 19 years old and had an IQ of 80 or above based on the Wechsler

Abbreviated Scale of Intelligence [Psychological Corporation, 1999]. There were no statistically significant differences between groups in age or IQ (see Table 1). The TD subjects (a) were free of psychiatric disorders according to the Adolescent Symptom Inventory-4 [Gadow, 1998]; (b) had a negative family history of any ASD in first and second degree relatives; (c) had scores on the Social Responsiveness Scale [Constantino, 2005], which is a measure of ASD symptoms, in the normal range; and (d) had uncomplicated pregnancies and were free of early developmental delays. The ASD subjects had a Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV-defined ASD diagnosis, which was verified by the Autism Diagnostic Observation Schedule [ADOS; Lord, Rutter, DiLavore, & Risi, 1999], the Autism Diagnostic Interview-Revised [ADI-R; Lord, Rutter, & Le Courteur, 1994], and expert clinical opinion. Only one participant did not satisfy ADOS criteria (e.g. missed by one point in the communication domain), but this participant exceeded ADI-R criteria and had a previous clinical diagnosis that was confirmed by a separate licensed psychologist.

Procedure

Participants completed this study in one or two visits, depending on whether the eligibility assessments were needed (ADOS and IQ were not repeated if they were completed within the past 3 years by research-reliable individuals; the ADI-R was not repeated if it had ever been completed by a research-reliable individual). Questionnaire data were collected on iPads (Apple, Inc., Cupertino, CA) via a secure online system for data collection and directly routed into an Access database. Total and subscale scores were automatically calculated. Any data that had to be hand-scored were double-entered and verified.

Measures

Characterization measures—Parents completed the Hollingshead rating of socioeconomic status. Participants completed the Pubertal Development Scale (PDS), which provides a well-validated noninvasive measure of pubertal status and serves as a better indicator of hormonal change compared with age [Carskadon & Acebo, 1993]. The severity of ASD symptoms was measured with the total score on the Social Responsiveness Scale (SRS) [Constantino, 2005]. In our sample, the mean score for adolescents with ASD was in the severe range (see Table 1).

Assessment of ER—The Response to Stress Questionnaire (RSQ), Social Stress Version, is a 57-item self-report questionnaire that was used as a measure of ER processes [Connor-Smith et al., 2000]. The RSQs was selected because (a) it is designed to measure a range of both voluntary and involuntary responses; (b) items cover both cognitive and behavioral responses; and (c) respondents are asked to identify social stressors that they have experienced and then rate the questions related to these specific stressors, making it somewhat more concrete and relevant. The RSQs is based on a five-factor model of coping developed and validated for TD adolescents (see Fig. 1).[1] This model includes two forms of

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[1]In an attempt to streamline some of the terminology, we simplified and clarified some of the original subscale names (e.g. we referred to the scale originally called disengagement coping as voluntary disengagement to better distinguish it from involuntary disengagement).

voluntary engagement: (a) primary engagement, which includes attempts to change the situation or one's emotions; and (b) secondary engagement, which includes attempts to adapt to or accept the situation; as well as, (c) voluntary disengagement, which involves active attempts to avoid or deny the situation; (d) involuntary engagement, which involves remaining focused on the situation and aroused; and (e) involuntary disengagement, which encompasses a more automatic (as compared with *voluntary* disengagement) shutting down reaction that includes emotional numbing or inaction.

Psychopathology measures—The Child Behavior Checklist (CBCL; parent report) and accompanying Youth Self-Report (YSR; self-report) provided a broad assessment of internalizing and externalizing problems [Achenbach & Ruffle, 2000; Song, Singh, & Singer, 1994]. Anxiety symptoms were assessed via parent and self-report on the Screen for Child Anxiety Related Disorders (SCARED; Birmaher et al., 1997). Depressive symptomatology was assessed via parent and self-report on the short form of the Mood and Feelings Questionnaire (MFQ; Messer et al., 1995). The internal consistencies of these measures in this sample are presented in Table 2. Correlations between parent and self-report for these measures are presented in Supporting Information Table S1. In addition, correlations between the various self-report measures of psychopathology are included in Supporting Information Table S2.

Data Analysis

All statistical analyses were conducted using SPSS v21 [IBM, 2012]. Because the RSQ subscales have differing numbers of total items, scores were normalized by dividing the raw subscale score by the total possible score for that subscale. To gauge the relative amount of each ER strategy used [Thomsen, 2002], the normalized values for each individual were subsequently converted to proportion scores by dividing by the individual's overall total score. Analysis of variance compared group means on variables of interest. Pearson correlations were performed to assess relations between ER types and further between ER and age, SRS, PDS, and psychopathology measures.

Results

Self-Reports of ER

The internal consistency of the RSQ subscales was excellent in both groups, with Cronbach's α equaling 0.89 and 0.95 for TD and ASD adolescents, respectively. There were no significant group differences in the total number of stressful situations reported [mean of 1.83 (standard deviation 2.15) for TD, 2.44 (2.2) for ASD] or how stressful the situations were reported to be [mean of 2.35 (0.79) for TD, 2.47 (0.77) for ASD], $P > 0.05$. Participant age, pubertal development, and SRS scores were not significantly correlated with the RSQ scales.

Table 3 summarizes group differences in the use of ER strategies. Participants with ASD reported significantly greater use of strategies involving denial and avoidance (voluntary disengagement), remaining focused on the stressor and aroused (involuntary engagement), and freezing or shutting down (involuntary disengagement) when dealing with social stress

as compared with TD controls, $P < 0.05$. Adolescents with ASD and TD participants reported similar rates of proactive efforts to change the problem or their response as well as attempts to adapt to and accept the situation (primary or secondary engagement), $P > 0.05$.

Reports of Psychopathology

Both self- and parent report supported higher levels of psychopathology in the ASD group across all measures (see Table 3). The only differences that did not reach statistical significance were self-report of externalizing behaviors on the YSR and self-report of anxiety on the SCARED, although there was a trend toward increased anxiety in ASD with a score of 20.16 vs. 14.78.

Correlations Between Different Forms of ER

In both ASD and TD adolescents, attempts to change the problem or emotion (primary engagement) were not significantly related to efforts to adapt to or accept the problem (secondary engagement; see Table 4). However, both of these voluntary engagement approaches was associated with reduced reporting of involuntary engagement, such as rumination and emotional arousal, with r-values ranging from −0.421 to −0.867. In the TD group, a greater tendency to use voluntary forms of disengaging such as distraction or avoidance was associated with fewer efforts to change or accept the problem or emotion (primary and secondary engagement). Conversely, in adolescents with ASD, voluntary disengagement was not significantly correlated with any other subscale. In both groups, the involuntary responses were positively correlated with each other.

Correlations Between ER Types and Psychopathology

Parent report of internalizing and externalizing problems on the CBCL (see Table 5) was not significantly correlated with any RSQ scale in the TD group. On the other hand, adolescents with ASD who reported a greater tendency to shut down (involuntary disengagement) had more parent-reported internalizing and externalizing problems on the CBCL. Further, voluntary engagement strategies were associated with CBCL scores in the ASD group. Specifically, adolescents with ASD who reported more attempts to change the situation or their emotions had less parent-reported externalizing behaviors, and adolescents with ASD who tried to adapt to the situation had less parent-reported internalizing problems.

In both groups, attempting to adapt to the situation (secondary engagement) was associated with fewer self-reported internalizing problems on the YSR (see Table 5). In the ASD group only, efforts to directly change the situation or emotional response (primary engagement) were also associated with fewer self-reported internalizing problems. On the other hand, involuntary ER responses, including remaining focused on the stressor and shutting down, were associated with more self-reported internalizing problems in both groups.

With regard to YSR externalizing problems, the patterns were opposite for the TD and ASD groups. Specifically, attempting to change one's emotion or the situation (primary engagement) was associated with fewer self-reported externalizing problems in the ASD group, but externalizing problems were not significantly correlated with any other RSQ scale. For the TD group, primary engagement was not associated with self-reported

externalizing problems, but externalizing problems were correlated with every other RSQ scale.

For both groups, ER strategies focused on making an effort to adapt to the situation (secondary engagement) were associated with fewer self-reported depressive symptoms on the MFQ, whereas the remaining focused on the stressor (involuntary engagement) was related to more self-reported depression (see Table 6). Involuntary disengagement from the stressor (e.g. emotional numbing or inaction) was associated with more self-reported depression in the TD group and more parent-reported depression in the ASD group. Aside from this one correlation in the ASD group, parent-reported depression was not significantly correlated with any RSQ scale in either group.

A similar pattern was found with parent report of anxiety, such that parent report on the SCARED was not significantly correlated with any RSQ scale for either group (see Table 6). Also similar to self-reported depression, attempts to adapt to the situation (secondary engagement) were associated with less anxiety. Both forms of involuntary ER responses were related to greater self-reported anxiety in both TD and ASD participants. Additionally, for only adolescents with ASD, attempting to change the situation or emotional response (primary engagement) was associated with lower anxiety. Strategies that involved voluntarily disengaging from the situation such as denial or distraction were not related to self-reported anxiety in either group.

Discussion

This is the first study to examine ER in adolescents with ASD. Using parent and self-report questionnaires, we explored the relation between ER approaches and a broad range of psychopathology. We found that adolescents with ASD reported greater use of involuntary forms of ER and that this is related to higher levels on broad measures of internalizing and externalizing behaviors as well as specific assessments of anxiety and depressive symptoms.

Self-Report of ER

Difficulty measuring ER in adolescents with ASD has been a barrier to prior research of ER in this population. Although ideally multi-method approaches should be utilized [Mazefsky et al., 2013], identifying useful self-reports is important for understanding internal aspects of ER. We found that self-reports of ER in ASD were as reliable (in terms of internal consistency) as TD adolescents on the RSQs. Further, with only one exception (i.e. a negative correlation between secondary engagement and voluntary disengagement in the TD group that was not found in the ASD group), the RSQ scales were correlated with each other in very similar pattern for both groups. The construct validity of the voluntary disengagement scale, which measures concepts such as active denial and avoidance, may require further attention, as results with this scale varied between populations and are at best only moderately associated with measures of psychopathology in two, previously reported, large 300+ samples of adolescents [Connor-Smith et al., 2000].

Although we were unable to explore other aspects of validity, finding similar inter-relationships between ER strategies for the ASD group and TD group, which was also fairly

consistent with prior research with TD adolescents [Connor-Smith et al., 2000], provides some support for use of this measure as a way to tap ER related to social stress in adolescents with ASD. This made it possible to investigate involuntary aspects of ER that have been previously unexplored in ASD.

Voluntary ER in ASD

Prior studies looking at ER in adults [Samson et al., 2012] and children with ASD [Rieffe et al., 2011] showed decreased use of voluntary ER approaches, such as cognitive reappraisal, and we anticipated a similar trend in our data. Contrary to our expectations, adolescents with ASD reported utilizing voluntary ER strategies such as attempting to change or accept the situation as much as the TD participants. This could be due to methodological differences in our studies. We used a general composite of different types of voluntary ER, and the prior studies focused on specific strategies (such as cognitive reappraisal; Samson et al., 2012).

In addition, given that there are so few studies investigating voluntary ER in ASD and each used a different age range, it is possible that differences across studies are related to developmental effects. Although we can only speculate given our use of a cross-sectional sample, it may be that children with ASD are delayed in their development of voluntary ER due to delayed maturation of the frontal cortex [Zilbovicius et al., 1995], but by adolescence they attempt voluntary ER strategies as much as their peers. However, this hypothesis would not be consistent with the only adult study of ER in ASD that found reduced use of voluntary ER strategies [Samson et al., 2012]. The adults in that study also reported reduced self-efficacy in their ER use, so it is possible that a perceived lack of success with ER leads to reduced attempts by adulthood.

Although we were unable to account for the effectiveness of strategy use in modifying emotions or adjusting to the situation, this might have also played a role in our findings. Less effective voluntary ER would be expected in ASD given the well-established difficulties accurately perceiving social and emotional cues in this population [Tse, Strulovitch, Tagalakis, Meng, & Fombonne, 2007] and the fact that voluntary approaches are context specific. However, we found that adolescents who reported greater use of voluntary ER approaches had lower scores across several measures of psychopathology, and this relationship was of the same strength or stronger for the ASD group compared with the TD group. Although we cannot confirm causality, this suggests that the use of voluntary ER strategies may be at least somewhat effective in protecting against depression and anxiety symptoms in this ASD sample.

Involuntary ER in ASD

Although ASD and TD groups did not differ in their use of primary and secondary engagement, the ASD group did report significantly higher rates of involuntary ER approaches that are usually considered maladaptive, such as experiencing intrusive thoughts, remaining aroused, or going blank and numb. This finding lends some support to the previously untested contention that ER in ASD may be characterized by more internally driven responses that are less organized and goal directed than in non-ASD populations [Mazefsky et al., 2013].

Relationship Between ER Types in ASD and Psychopathology

In addition to identifying group differences in ER in ASD, it is important to explore how ER may increase risk for developing a comorbid disorder [Mazefsky et al., 2013]. Prior examinations of the RSQs in TD adolescents support the expected association between greater use of strategies that are typically considered adaptive and less internalizing and externalizing concerns, and greater use of maladaptive strategies with more internalizing and externalizing concerns [Connor-Smith et al., 2000]. We replicated this finding using the same measures. Specifically, correlations between self-report of internalizing and externalizing problems on the YSR and the RSQ scales were in the same direction and of generally similar magnitude in our ASD and TD samples and the original Connor-Smith et al. study of TD adolescents. Although the correlations were quite similar, some did not reach significance in our study, which can be attributed to our smaller sample size.

We found a much weaker association between psychopathology and ER for TD adolescents when parent report was utilized (e.g. none of the correlations with any of the parent-reported measures reached significance). This may reflect the fact that depression and anxiety are internal processes that may be difficult for parents to accurately gauge. Parents of adolescents with ASD may be at least somewhat more aware or observant of their children's behaviors given their identified special needs, as noted by stronger correlations between parent and self-reports on measures of psychopathology in the ASD group. In the ASD group only, adolescents who experienced more numbing and inaction following social stress (involuntary disengagement) were rated by their parents as having more depression symptoms and general internalizing problems. The use of ER strategies focused on adapting to the situation (secondary engagement) was also associated with fewer parent-reported internalizing symptoms in the ASD group only.

Self-reports of anxiety and depression revealed some significant associations with ER that were, for the most part, similar across groups. For example, attempts to adapt to the situation through positive thinking, cognitive restructuring, and acceptance (secondary engagement) were associated with less depression and anxiety, and experiencing rumination, intrusive thoughts, and heightened emotional and physical arousal (involuntary engagement) were associated with more depressive and anxiety symptoms in both groups. These findings are consistent with research in the non-ASD depression and anxiety literature and suggest that adolescents with ASD may share similar risk factors, at least in terms of ER responses, for these disorders. One point of difference was a strong correlation between involuntary disengagement responses such as feeling numb or experiencing inaction and depression in the TD group that was not found in the ASD group. It is possible that involuntary disengagement is capturing the blunted affect that can be common in ASD regardless of psychiatric profiles. If so, this could have muted the specific association with depression symptoms in the ASD group.

Limitations and Future Directions

Several aspects of the study design should be considered when interpreting our findings. Given that the proficient use of the English language was required in order to complete the questionnaires, only high-functioning individuals with ASD were included. Further, most

participants had above-average intelligence. It is unclear to what extent ER in lower functioning adolescents with ASD would differ from ER in high-functioning individuals. In addition, study advertisements described it as a study to understand emotions in ASD. Therefore, it is possible that families whose children struggled in this area were more inclined to participate.

The cross-sectional nature of the study precludes us from drawing conclusions about directions of influence and limits our ability to understand developmental factors. Follow-up longitudinal studies are needed, particularly if adolescence represents a period during which individuals with ASD utilize voluntary, adaptive ER approaches to a similar degree as their TD peers. Continued and robust developmental improvements have been documented in adolescents with autism similar to controls [Luna et al., 2007], suggesting that ER therapies targeting adolescents with ASD have the potential to result in meaningful behavioral and neural changes. While this seems promising, a more in-depth investigation of developmental effects on ER is still needed. Although our findings differed from other cross-sectional studies using different age ranges, which allowed us to speculate about developmental shifts in ER across the lifespan, we failed to find an effect of age or puberty within our adolescent age range. The use of longitudinal sample may be more fruitful for identifying subtle changes in ER over time, and it would also allow one to tease apart whether ER development in ASD is in fact deviant (qualitatively different) or simply delayed because of overall social and emotional immaturity.

Future studies should ideally include biological or objective measures to tap ER processes in addition to questionnaire data. We are unable to say with certainty that the ASD group practices the strategies that they endorsed on self-report. Although the internal consistency of the scales was high, it is nonetheless possible that this reflects a tendency to endorse everything. However, visual inspection of the proportion scores suggested that the different ER strategies were endorsed to slightly different degrees. Moving forward, it will be important to incorporate both parent and child-report as we found important differences in their associations with psychopathology, and the use of both report sources may provide a more thorough picture of the psychopathology. It is also important to remember that some of the questionnaires used in this study have not been validated in an ASD sample. Yet it is encouraging to note that a recent study [van Steensel, Deutschman, & Bogels, 2013] demonstrated that the SCARED had a higher sensitivity rate for both self- and parent reports in children with ASD and comorbid anxiety vs. children with only anxiety. Finally, there is overlap between some items assessing involuntary engagement strategies and symptoms of depression/anxiety. As a result, the correlation between this measure and symptoms could be artificially inflated. However, research with TD samples using other measures of ER has shown that the relationship between involuntary engagement strategies and depression remains strong even after the elimination of the overlapping symptoms [Joormann et al., 2006].

Clinical Implications

This study found that, similar to individuals without ASD, adolescents who report using voluntary ER strategies to change one's emotion, change the situation, or adapt to the

situation also have less psychopathology. There is also a strong relationship between involuntary ER responses such as rumination and emotional numbing and the presence of psychopathology. Although a causal relationship has yet to be proven, it is reasonable to speculate that decreasing maladaptive involuntary reactions and increasing the appropriate use of voluntary ER strategies, such as problem solving and cognitive restructuring, could aid in the treatment of or prevent the development of a broad range of symptoms, including depression and anxiety. Indeed, several studies of CBT in ASD demonstrate promising improvements in target symptoms after intervention [Reaven, Blakeley-Smith, Culhane-Shelburne, & Hepburn, 2012; Sofronoff, Attwood, Hinton, & Levin, 2007; White, Koenig, & Scahill, 2010; Wood et al., 2009]. More recent trials have expanded to include mindfulness and acceptance-based approaches [Spek, van Ham, & Nyklíe, 2012]. Our finding of increased use of involuntary strategies in ASD, together with their positive association with psychopathology, may suggest that additional work utilizing mindfulness and other acceptance-based as well as distress-tolerance approaches is warranted. Finally, given that patterns of association were fairly similar for both anxiety and depression, a transdiagnostic approach targeting ER skills, rather than discrete disorders, may prove useful across different manifestations of emotional distress in ASD. A stronger emphasis on transdiagnostic treatment of underlying mechanisms together with a better understanding of patterns of ER that commonly manifest in ASD may also help alleviate possible over-diagnosis of comorbid psychiatric disorders in individuals with ASD [Mazefsky et al., 2012].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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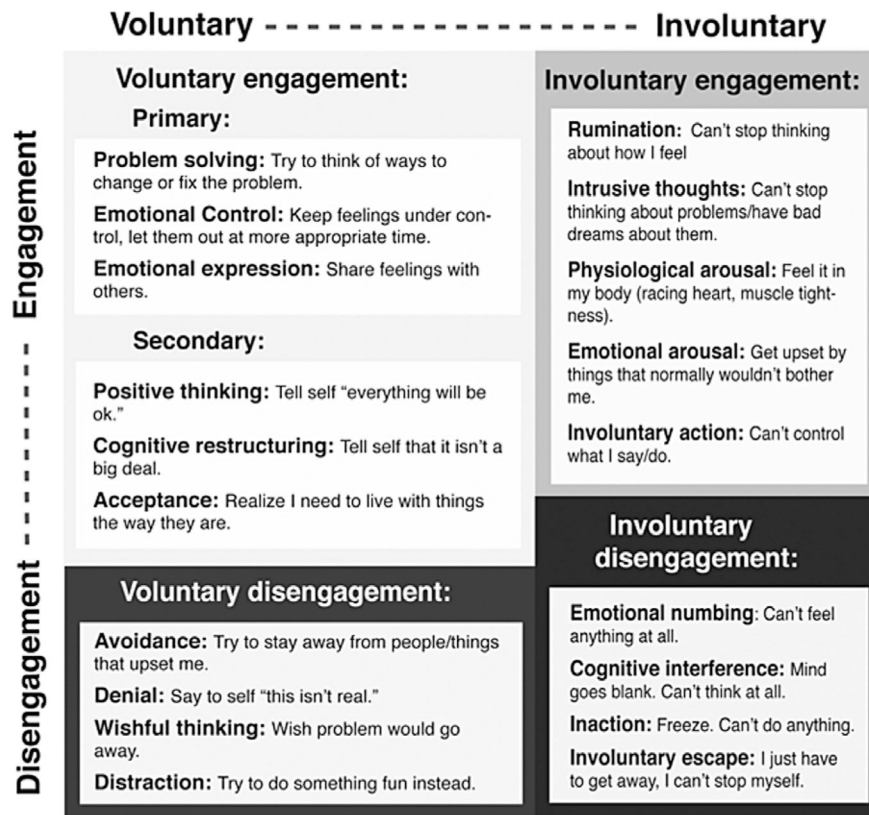
Figure 1.
Emotion regulation types from the Response to Stress Questionnaire [Connor-Smith et al., 2000] with examples.

Note. Emotion regulation factors are based on confirmatory factor analysis of the Response to Stress Questionnaire by Connor-Smith et al. [2000]. Figure shows the five factors (e.g. primary engagement). In a box beneath each factor name are the subscales (e.g. problem solving) with abbreviated item examples. Some factor names were slightly modified from the original names to increase clarity and simplify.

Table 1

Group Demographics

	ASD (*n* = 25)	Control (*n* = 23)	*P*
Age	15.22 (2.25)	15.56 (2.76)	0.640
Socioeconomic status	49.15 (10.98)	48.52 (10.15)	0.238
Pubertal Development Scale	17.88 (3.00)	16.74 (3.97)	0.092
WASI full scale IQ	110.48 (13.59)	113.23 (12.87)	0.482
SRS total male[a]	78.08 (15.34)	39.77 (5.01)	0.000
Percent male	96.0% (*n* = 24)	95.7% (*n* = 22)	0.952

[a]The female with autism spectrum disorder (ASD) had an SRS score of 65, and the female control had an SRS score of 54.

WASI = Wechsler Abbreviated Scale of Intelligence; SRS = Social Responsiveness Scale.

Table 2

Cronbach's Alpha Internal Consistency for Study Questionnaires by Group

	ASD (*n* = 25)	Control (*n* = 23)
YSR internalizing	0.91	0.83
CBCL internalizing	0.92	0.77
YSR externalizing	0.91	0.87
CBCL externalizing	0.91	0.78
MFQ child	0.85	0.87
MFQ parent	0.86	0.58
SCARED child	0.95	0.92
SCARED parent	0.95	0.89
Response to stress questionnaire	0.95	0.89

ASD, autism spectrum disorder; CBCL, Child Behavior Checklist; MFQ, Mood and Feelings Questionnaire; SCARED, Screen for Child Anxiety Related Disorders; YSR, Youth Self-Report.

Table 3

Descriptive Statistics

	ASD (*n* = 25)	Control (*n* = 23)	*P*
Response to stress questionnaire	*M* (SD)	*M* (SD)	
Primary engagement	0.59 (0.15)	0.60 (0.12)	0.748
Secondary engagement	0.65 (0.14)	0.64 (0.11)	0.825
Voluntary disengagement[*]	**0.57 (0.13)**	**0.45 (0.10)**	**0.001**
Involuntary engagement[*]	**0.50 (0.17)**	**0.39 (0.11)**	**0.015**
Involuntary disengagement[*]	**0.51(0.17)**	**0.37 (0.10)**	**0.001**
Measures of psychopathology	*M* (SD)	*M* (SD)	
YSR internalizing[*]	**59.40 (10.3)**	**50.78 (8.7)**	**0.003**
CBCL internalizing[*]	**65.60 (12.1)**	**43.70 (8.9)**	**0.000**
YSR externalizing	49.92 (10.1)	47.61 (10.9)	0.451
CBCL externalizing[*]	**52.96 (9.4)**	**42.70 (7.3)**	**0.000**
MFQ child[*]	**5.68 (4.7)**	**2.57 (3.4)**	**0.012**
MFQ parent[*]	**5.60 (4.6)**	**1.17 (1.4)**	**0.000**
SCARED child	20.16 (14.6)	14.78 (10.4)	0.153
SCARED parent[*]	**27.00 (15.4)**	**7.43 (7.3)**	**0.000**

Bolded values represent significant differences.

[*] Denotes statistically significant ($P < 0.05$) difference between the autism spectrum disorder (ASD) and typically developing groups. Normalized scores are reported for Response to Stress Questionnaire subscales. T-scores are reported for the Youth Self-Report (YSR) and Child Behavior Checklist (CBCL). Raw scores are reported for Mood and Feelings Questionnaire (MFQ) and Screen for Child Anxiety Related Disorders (SCARED).

SD, standard deviation.

Table 4

Correlations Between Emotion Regulation Strategies by Group

Autism spectrum disorder	Primary engagement	Secondary engagement	Voluntary disengagement	Involuntary engagement
Secondary engagement	0.204			
Voluntary disengagement	−0.215	−0.073		
Involuntary engagement	**−0.584**[**]	**−0.718**[***]	−0.195	
Involuntary disengagement	**−0.513**[**]	**−0.755**[***]	−0.150	**0.618**[***]

Controls	Primary engagement	Secondary engagement	Voluntary disengagement	Involuntary engagement
Secondary engagement	0.138			
Voluntary disengagement	**−0.442**[*]	**−0.487**[*]		
Involuntary engagement	**−0.421**[*]	**−0.867**[***]	0.353	
Involuntary disengagement	**−0.650**[***]	**−0.637**[***]	0.266	**0.676**[***]

Bolded values represent significant correlations.

[*] Correlation is significant at the 0.05 level (two-tailed).

[**] Correlation is significant at the 0.01 level (two-tailed).

[***] Correlation is significant at the 0.001 level (two-tailed).

Table 5

Correlations Between RSQ and CBCL/YSR by Group

ASD	YSR internalizing	YSR externalizing	CBCL internalizing	CBCL externalizing
Primary engagement	**−0.435**[*]	**−0.457**[*]	−0.284	**−0.494**[*]
Secondary engagement	**−0.609**[***]	−0.281	**−0.415**[*]	−0.308
Voluntary disengagement	0.377	0.344	0.064	0.356
Involuntary engagement	**0.507**[**]	0.395	0.324	0.246
Involuntary disengagement	**0.472**[*]	0.181	**0.468**[*]	**0.420**[*]

Control	YSR internalizing	YSR externalizing	CBCL internalizing	CBCL externalizing
Primary engagement	−0.188	−0.255	−0.380	−0.210
Secondary engagement	**−0.530**[**]	**−0.781**[***]	0.222	−0.061
Voluntary disengagement	0.245	**0.470**[*]	−0.078	0.226
Involuntary engagement	**0.428**[*]	**0.732**[***]	−0.046	0.149
Involuntary disengagement	**0.535**[**]	**0.544**[**]	0.170	0.016

Bolded values represent significant correlations.

[*]
Correlation is significant at the 0.05 level (two-tailed).

[**]
Correlation is significant at the 0.01 level (two-tailed).

[***]
Correlation is significant at the 0.001 level (two-tailed).

ASD, autism spectrum disorder; CBCL, Child Behavior Checklist; RSQ, Response to Stress Questionnaire; YSR, Youth Self-Report.

Table 6

Correlations Between RSQ and SCARED/MFQ by Group

ASD	MFQ C	MFQ P	SCARED C	SCARED P
Primary engagement	−0.199	−0.268	**−0.452**[*]	−0.013
Secondary engagement	**−0.513**[**]	−0.309	**−0.540**[**]	−0.248
Voluntary disengagement	0.312	0.245	0.138	0.102
Involuntary engagement	**0.411**[*]	0.066	**0.587**[**]	0.087
Involuntary disengagement	0.244	**0.470**[*]	**0.468**[*]	0.193

Control	MFQ C	MFQ P	SCARED C	SCARED P
Primary engagement	−0.283	0.138	−0.370	−0.274
Secondary engagement	**−0.654**[***]	−0.099	**−0.434**[*]	0.054
Voluntary disengagement	0.231	0.157	0.035	0.071
Involuntary engagement	**0.701**[***]	0.050	**0.526**[*]	0.098
Involuntary disengagement	**0.561**[**]	−0.172	**0.620**[**]	0.060

Bolded values represent significant differences.

[*] Correlation is significant at the 0.05 level (two-tailed).

[**] Correlation is significant at the 0.01 level (two-tailed).

[***] Correlation is significant at the 0.001 level (two-tailed).

ASD, autism spectrum disorder; MFQ, Mood and Feelings Questionnaire; RSQ, Response to Stress Questionnaire; SCARED, Screen for Child Anxiety Related Disorders; YSR, Youth Self-Report.