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Alexithymia level and response to computer-based training in cognitive behavioral therapy among cocaine-dependent methadone maintained individuals

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Abstract

Background—Alexithymia, a characteristic marked by poor ability to identify, define and communicate emotions, has been associated with poorer treatment outcome, including traditional clinician delivered CBT. Computerized cognitive behavioral therapy (CBT4CBT), an effective adjunct to treatment, may provide a means of conveying skills without requiring interaction with a clinician.

Methods—Seventy-three methadone maintained, cocaine dependent individuals participating in an 8-week randomized clinical trial comparing standard methadone maintenance to methadone maintenance plus CBT4CBT completed the Toronto Alexithymia Scale (TAS-20) at pretreatment, post-treatment, and follow-ups conducted one, two, and 6 months after treatment.

Results—There were no statistically significant differences on baseline TAS-20 scores by multiple demographic and substance use variables including gender and substance use severity. Higher TAS-20 scores were associated with somewhat higher levels of distress as measured by the Beck Depression Inventory and multiple Brief Severity Index scales. TAS-20 scores remained relatively stable throughout the duration of treatment and follow-up. Indicators of treatment process, including treatment retention, adherence and therapeutic alliance, were not significantly correlated with TAS-20 scores. There was a significant interaction of alexithymia and treatment condition, such that individuals with higher baseline scores on the TAS-20 submitted significantly higher percentages of cocaine-negative urine toxicology specimens and reported a higher

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Conflict of Interest

Dr. Carroll is a consultant to CBT4CBT LLC, which makes CBT4CBT available to qualified clinical providers and organizations on a commercial basis. Dr. Carroll works with Yale University to manage any potential conflicts of interest.

The other authors report no financial relationships with commercial interests.

Contributors

Dr. Carroll was Principal Investigator of the trial and wrote the protocol. Dr. Morie with Ms. Hunkele and Nich undertook the statistical analysis. Dr. Morie wrote the first draft of the paper. All authors contributed to the editorial process and have approved the final submitted version of the manuscript.

percentage of abstinence days, and longer periods of consecutive abstinence within treatment when assigned to CBT4CBT compared with treatment as usual.

Conclusions—These findings suggest that individuals with increased alexithymia may benefit from computerized CBT; possibly via reduced demands on interpersonal skills and interactions associated with computerized therapies.

Keywords

Alexithymia; Cognitive behavioral therapy; web based therapies

1. INTRODUCTION

Emotional dysregulation is a common feature among substance users (Cheetham et al., 2010). This feature can manifest as alexithymia, which is characterized by a reduced ability to identify and describe emotional states as well as an impoverished fantasy life (Taylor, 2000). Estimates of rates of alexithymia in the in the general population range between 6% and 10% (Hintikka et al., 2001; Kokkonen et al., 2001). Rates far higher than these have been reported in samples of alcohol users, with rates as high as 78% in one study (Rybakowski et al., 1988). A recent review of alexithymia in alcohol use disorders indicated prevalence rates between 45% and 67% (Thorberg et al., 2009). Increased alexithymia has also been associated with a family history of alcohol abuse (Pombo, 2014). Individuals with illicit drug use disorders also have higher levels of alexithymia, with reported rates of 42% in one study and 50% in another (Haviland et al., 1994, 1988). Higher rates of alexithymia in individuals with substance use disorders have also been found when directly compared to healthy volunteers (Ghalehban and Besharat, 2011).

While alexithymia is associated with addiction, questions remain regarding its relationship to the development or maintenance of substance use disorders. For example, the temporal relationship between alexithymia and development of dependence is unclear. Previous work has suggested that alexithymia may predict alcohol consumption in social drinkers (Bruce et al., 2012), and work in the children of problem alcohol users suggest that alexithymia may, in tandem with frontal lobe dysfunction, be a risk factor for future substance use (Lyvers et al., 2012). If alexithymia predates the onset of drug use, then the high rates of alexithymia in substance abuse may be explained by the use of drugs or alcohol to relieve the emotional dysregulation associated with alexithymia (Stasiewicz et al., 2012). The degree to which levels of alexithymia may vary with severity of substance use and abstinence is also unclear. Conceptions of alexithymia as a trait, rather than a state, are supported by findings that levels of alexithymia did not change over a 6 week course of treatment (Pinard et al., 1996). However, if levels of alexithymia are worsened by drug dependence, then this emotional blunting may be relieved somewhat by long-term abstinence, as suggested by the findings of de Haan (de Haan et al., 2014).

Another major question concerns the relationship between alexithymia and treatment adherence and outcome. Alexithymia may interfere with treatment success, as individuals for whom it is difficult to recognize and describe emotional states may not be able to adequately regulate these states or recognize their relationship to drug use. Laos and

colleagues reported that alexithymia status at treatment intake predicted poorer treatment outcomes in a cohort of alcohol abusers (N= 46) at 15 months (Loas et al., 1997). In a study of 60 male outpatient alcohol users, those with higher alexithymia reported more episodes of relapse after one year than those with low levels of alexithymia (Ziolkowski et al., 1995). In another sample of 230 outpatient substance users, those with higher alexithymia also showed poorer treatment adherence, which may underlie poorer treatment outcome (Cleland et al., 2005).

Other work, however, has suggested that alexithymia may have little or no effect on treatment outcome. In a study involving a cohort of 100 alcohol abusers, no effects of alexithymia were seen on treatment outcome, as indicated by self-reports of drug use 30 days after cessation of an inpatient treatment program that consisted of a combination of Motivational Interviewing (MI) and CBT approaches with group therapy (de Haan et al., 2012). Few studies have evaluated the relationship of alexithymia to specific types of treatment, however. It is possible that alexithymia might moderate response to different treatment approaches in different ways. For example, individuals with high alexithymia may encounter more problems in a group setting where interpersonal communication regarding individual experience and affect are required.

Cognitive behavioral therapy (CBT) has been demonstrated to be an effective treatment approach for a wide range of addictive (Dutra et al., 2008; Magill and Ray, 2009) and other psychological (Tolin, 2010) disorders. However, CBT may be challenging for individuals with alexithymia as it requires identifying, processing, and changing thoughts and feelings in the presence of a clinician. An early study by our group found poorer response to CBT in those with alexithymia relative to supportive clinical management among 93 outpatient cocaine users (Keller, 1995). However, it is not clear whether apparent poorer response to CBT among individuals with alexithymia reflected difficulties with discussing emotions in an interpersonal context, or an inability to benefit from a treatment linking emotion, behavior, and cognition, or other factors.

The recent development and validation of computerized versions of CBT and other interventions is an important strategy for broadening the availability of evidence-based therapies (Bickel et al., 2011; Kiluk et al., 2011). Emerging data on the efficacy of computerized CBT is promising relative to standard therapist-administered CBT, and multiple recent studies indicate its promise in a range of settings and populations (Budney et al., 2011; Campbell, 2014; Kay-Lambkin et al., 2011). One key issue relevant to the dissemination of computer-assisted therapies is clarification of the types of individuals who respond well versus poorly to these interventions. Alexithymia, via making it difficult to communicate their feelings to a clinician, may be a factor that moderates response to traditional CBT, which involves intensive interaction with a clinician. It is possible that this is mitigated in computerized CBT, which may make fewer demands in terms of recognizing and communicating affect states and cognitions. To investigate this possibility, we used data from a recently completed trial of computerized CBT (CBT4CBT) (Carroll, 2014) among cocaine-dependent methadone-maintained individuals to address the following research questions. First, to what extent might alexithymia be associated with other measures of baseline functioning, drug-use severity, and psychopathology? We expected higher

alexithymia would be associated with more dysphoria and a higher frequency of psychiatric disorders, as well as more severe drug use (Bankier et al., 2001; Evren., 2008; Haviland et al., 1994; Saladin et al., 2012). Second, to what extent might alexithymia moderate treatment engagement and process? We hypothesized that individuals higher in alexithymia would have more difficulty engaging in treatment. Third, to what extent does alexithymia change over time? Based on the literature in alexithymia in substance abusers and psychiatric patients, we hypothesized that alexithymia would remain unchanged throughout treatment (Pinard et al., 1996; Salminen et al., 1994). Finally, to what extent might alexithymia represent a potential moderator of treatment response? Given that the more structured, computer-delivered format might appeal to individuals who have difficulty expressing feelings, we anticipated that individuals with higher levels of alexithymia might respond more favorably to computerized CBT than to treatment as usual (TAU; Carroll et al., 2009; Kiluk et al., 2010).

2. METHODS

2.1 Overview of study and participants

Data were drawn from an 8-week randomized clinical trial (Carroll et al., 2014) in which 101 methadone-maintained individuals who met current DSM-IV criteria for cocaine dependence were randomized to standard methadone treatment (TAU, consisting of daily methadone plus weekly group treatment), or TAU plus access to the CBT4CBT program. As described in the main trial report, 154 individuals were screened for the study; of these, 33 were not eligible due to unstable psychiatric conditions (N=8), failure to meet DSM-IV criteria for current cocaine dependence (N=20), suicidality (N=1), or cognitive issues (N=4). Nineteen individuals were not randomized due to failure to complete screening (N=16) or a decision not to participate (N = 3). One additional individual was not randomized due to uncertain eligibility. Participants were randomly assigned to treatment groups via a computerized urn randomization program (Stout et al., 1994) to balance treatment groups with respect to gender, ethnicity, education, and frequency of cocaine use at baseline. Participants assigned to the CBT4CBT arm of the study were introduced to the program by a research assistant who answered questions and helped participants access the system. CBT4CBT sessions occurred in a private room on a dedicated, password-protected computer. Participants had individualized login credentials to protect confidentiality. Of the 101 individuals randomized to treatment, 73 completed the Toronto Alexithymia scale, which was initiated midway during the trial.

2.2 Interviews and Questionnaires

At intake, participants were assessed using a battery of assessments. These included the Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994) and the Structured Clinical Interview for DSM-IV (First, 1995). Participants also completed the Addiction Severity Index (McLellan et al., 1985), a semi-structured interview that evaluates problems in 7 dimensions commonly affected by addiction. The Substance Use Calendar, which is similar to the Timeline Follow Back method (Sobell and Sobell, 1992) was used to collect reports of alcohol and illicit drug use on a day-by-day basis throughout the course of the study.

The TAS-20 has strong psychometric validation in a range of samples (Bagby et al., 1994; Haviland et al., 1988; Loas et al., 2001; Parker, 2003; Taylor, 1985). Factor analyses have indicated it has three primary subscales that correspond to aspects of alexithymia that may, either independently or in combination, be associated with addiction severity and treatment success (Bagby et al., 1994). These factors relate to difficulty identifying feelings (Factor 1), difficulty describing feelings (Factor 2), and external thinking (Factor 3). This factor structure was confirmed in a cohort of 769 healthy controls and 659 patients with substance abuse or eating disorders (Loas et al., 2001). Bagby and colleagues suggested that scores of 61 or more were associated with the presence of alexithymia, scores of 51 or below are associated with non-alexithymia, and a range between 52 and 60 was associated with “possible alexithymia.” Other work suggests the conservative cutoff score of 61 or greater as a marker of alexithymia (Taylor et al., 1996).

The ASI and TAS-20 were repeated at the end of treatment (8 weeks) and again at follow-up interviews conducted 1, 2 and 6 months after treatment termination. Substance use was assessed via urine toxicology screens collected at baseline, twice weekly during treatment, and at each follow-up. The Beck Depression Inventory (Beck et al., 1988), a widely used and well validated self-report measure of depression, was used to measure the severity of depressive symptoms. The Brief Symptom Inventory (Derogatis and Melisaratos, 1983), a validated self-report measure of psychiatric symptoms which provides indices of distress in nine areas, was used to evaluate severity of psychological symptoms. The Positive and Negative Affect Scale (Watson et al., 1988) was used to measure the extent of negative affect (examples include irritability or nervousness) and positive affect (interest and enthusiasm). The Emotion Regulation Questionnaire (Gross and John, 2003) was used to assess ability to both reappraise and suppress emotions. The client version of the Working Alliance Inventory (WAI-C; Horvath, 1989), as well as an adapted version of the WAI for use in assessing technology based interventions (Kiluk et al., 2014), were used to evaluate the perceived working relationship with participants’ methadone program clinicians and the CBT4CBT intervention, respectively.

2.3 Data analyses

Simple correlations were used to evaluate relationships between total TAS-20 scores and baseline demographic, psychiatric and substance use indicators as well as relationships with measures of treatment adherence (participating and retention in group and individual sessions conducted as part of TAU, number of modules and completion of assigned CBT4CBT homework). To control for the number of relationships evaluated, we set the significance level at $p < .01$. The hypothesis concerning possible change in alexithymia scores over the duration of treatment was examined using a 2-by-5 repeated measures analysis of variance with factors of treatment condition (CBT4CBT + TAU or TAU only) and time (total TAS-20 score at each assessment period—baseline, end of treatment, and 1, 2, and 6 month follow-up evaluations). Regarding treatment outcome, the primary outcome measures were proportion of cocaine-negative urine toxicology samples and self-reported reported abstinence during treatment; independent variables of interest were treatment condition and TAS-20 score at baseline evaluation. The hypothesis concerning improved drug use outcomes in individuals with alexithymia who were assigned to CBT4CBT was evaluated

using moderator analyses with the baseline alexithymia score and the interaction of alexithymia score and treatment condition as the predictors in a regression analyses. Analysis of the follow-up data were conducted via random effect regression models for longitudinal data (frequency of cocaine use by month) and simple ANOVAs for variables measured only once (e.g., percent of days abstinent over the follow-up). Finally, moderator analyses were conducted to evaluate the region of statistical significance using the Johnson-Neyman technique (Hayes and Matthes, 2009).

3. RESULTS

3.1 Alexithymia and baseline substance use and psychopathology

The average total TAS-20 score for all participants at baseline was 58.6 with a standard deviation of 6.3. As shown in Table 1, other than a significant finding for the presence of lifetime marijuana disorder, there were no statistically significant differences in alexithymia level by gender, employment status, or by presence of DSM-IV Axis I disorders including other substance use, depression, or anxiety disorders. Table 2 provides simple correlations between TAS-20 scores and continuous measures of substance use frequency and severity as well as indicators of psychiatric distress (ASI composite scores, BDI, PANAS, ERQ and BSI). There were moderate (range .23-.35) statistically significant relationships between TAS-20 total scores and the BDI, and 7 of the 9 BSI scales, where higher TAS-20 scores were associated with higher levels of symptoms on the BDI and BSI scales.

3.2 Alexithymia and treatment adherence

Participant's adherence to treatment in the TAU group and the CBT4CBT+TAU group was correlated with TAS-20 scores. Measures of interest included treatment retention, hours of group attendance as well as attendance to sessions with clinicians, and the scores on the Working Alliance Inventory. In the case of the group assigned to CBT4CBT, variables also included the number of CBT modules completed and number of homeworks returned as well as the scores on the technology version of the Working Alliance Inventory. However, these aspects of treatment adherence were not correlated with TAS-20 scores (all p values $> .06$).

3.3 Change in alexithymia over time

Alexithymia status did not change significantly throughout the duration of the study, overall or by treatment group. At the 6-month follow-up, 61 of the original 73 participants completed the TAS-20. The 2-by-5 repeated measures ANOVA indicated no significant effect of time ($F=.9, p>.7$) and no time-by-group interaction ($F=.74, p>.50$).

3.4 Alexithymia and cocaine outcomes by condition

There was a main effect of baseline TAS-20 score on percentage of negative cocaine urine submitted in treatment and maximum consecutive days of abstinence during treatment, indicating that higher alexithymia scores were associated with better outcomes overall. Main effects of treatment condition also indicated better overall outcomes for CBT4CBT compared with TAU, as was found in the main sample. In addition, for both percentage of negative cocaine urine specimens and maximum consecutive days of abstinence during treatment, there was an interaction of alexithymia and treatment condition, suggesting that

alexithymia moderates the effect of CBT4CBT with improved outcomes for those with higher scores on the TAS-20 ($p<.05$). Alexithymia was also a moderator of outcome for self-reported percentage of days abstinent, again showing that higher alexithymia was associated with better outcomes in CBT4CBT ($p<.05$). Regions of significance by analyses using the Johnson-Neyman technique indicated a TAS-20 score of 61 for percent negative urine toxicology screens and 60 for maximum days of consecutive abstinence.

Regarding follow-up outcomes, repeated measures ANOVAs indicated no significant difference in self-reported cocaine use (percent days of abstinence) during the follow up period by treatment group, baseline alexithymia score, or the interaction of alexithymia by treatment group. Random effects regression models, evaluating change in frequency of use over time by alexithymia level (using the TAS-20 scores and region of significance indicated cut-off of 61), were consistent with the within-treatment findings (Carroll et al., 2014): These indicated a trend toward increase in cocaine use over time for the TAU group relative to CBT4CBT (monthly cocaine use over time by treatment condition, $F = 3.4$, $p=.06$), but no effect of alexithymia ($F = .011$, $p=.91$), or the interaction of treatment and alexithymia ($F = 2.8$, $p=.09$). Figure 2 illustrates relationships between alexithymia levels and outcome over time by treatment condition. There were no significant differences by treatment condition in terms of rates of cocaine-negative urine specimens collected at the 1, 2, or 6 month follow-up interviews.

4. DISCUSSION

This secondary analysis of alexithymia as measured by the TAS-20 as a moderator of outcome in a randomized clinical trial of computerized CBT versus standard treatment among cocaine-dependent methadone maintained individuals indicated the following. First, the level of alexithymia in this sample was relatively high, with a mean score on the TAS-20 of 58.6. Alexithymia scores were not significantly related to most baseline demographic variables, indicators of substance use severity, or frequency or DSM Axis I disorders, although they differed between those who did and did not report a lifetime marijuana disorder. However, there were multiple significant correlations with alexithymia scores with indicators of greater psychological distress, including the Beck Depression inventory and most BSI subscales. Second, alexithymia scores remained stable over the course of treatment and follow-up in this sample, and were not closely related to treatment adherence. Finally, there were consistent indicators that individuals with higher levels of alexithymia had significantly better cocaine use outcomes overall, and particularly when assigned to CBT4CBT compared with TAU.

As predicted, there were high levels of alexithymia in the study sample. The mean TAS-20 score is comparable to levels observed in previous reports with substance using populations (de Haan et al., 2014; Haviland et al., 1994), and higher than norms reported for non-psychiatric populations (males = 47.4, females = 47.4) reported by (Bagby et al., 1994). Individuals with higher alexithymia reported more symptomatology on the subscales of the BSI and the BDI. This finding is consistent with interpersonal difficulties encountered by individuals with alexithymia (Vanheule et al., 2010), and the relatively strong relationships

between distress and alexithymia are also consistent with previous literature (Honkalampi et al., 2000).

Turning to our second hypothesis, alexithymia was not strongly associated with treatment retention or adherence. For the overall sample, there were no differences in days retained in treatment, or group or individual session attendance during the protocol. Alexithymia level was not associated with differences in participant measures of alliance with their methadone treatment program clinician (WAI-C). Within the group assigned to CBT4CBT, TAS-20 scores were not significantly associated with completion of CBT4CBT modules, homework assignments or reported 'alliance' with CBT4CBT as measured by the adapted WAI-Tech (Kiluk et al., 2014). Although we had predicted poorer treatment adherence among those with higher alexithymia, these findings are in line with other data suggesting that individuals with alexithymia do not necessarily avoid treatment (Ogrodniczuk et al., 2009).

Our third hypothesis was supported in that alexithymia scores did not change over time. This is different from the findings reported by de Haan et al (2014), who found minor changes in alexithymia in a cohort of 101 alcohol and polysubstance users over a three-week, inpatient detoxification period and suggested that alexithymia is both state and trait. A major difference between these two studies is that while our data included individuals stabilized on methadone, de Haan's sample was undergoing detoxification and the observed changes in alexithymia may reflect dynamic withdrawal symptoms. Other work has suggested that alexithymia is a stable personality trait (Tolmunen et al., 2011), and it has been shown that genetic factors may contribute to alexithymia (Cairncross et al., 2013; Ham et al., 2005). Taken together with the present work showing little change over the follow-up, it appears that alexithymia is relatively stable in this population, regardless of variation in frequency of drug use over time.

Consistent with the final hypothesis, our data suggested that participants with higher TAS-20 scores had better cocaine use outcomes overall when assigned to computerized CBT relative to TAU. Although previous work by our group indicated that cocaine users in the higher ranges of alexithymia had poorer response to clinician-delivered CBT (Keller, 1995), this may have related to the interpersonal demands of traditional CBT. Computerized CBT therapy may reduce the complication of lessened emotional awareness in social situations by offering information about how to deal with urges to use, offering other solutions instead of pursuing drugs, and do so without the added difficulty of processing internal experiences in the presence of a clinician. Given the findings in previous work that suggested that those with alexithymia may encounter difficulty relating to therapists (Ogrodniczuk et al., 2005; Rasting et al., 2005) and difficulties those with higher levels of alexithymia may encounter recounting emotions in therapies that require interpersonal communication (Meganck et al., 2009), it is possible that the less interactional nature of computerized CBT was more helpful in the population examined here. This relationship appeared to persist during follow-up, but not at a statistically significant level, possibly due to sample size.

Finally, we note that our region-of-significance analyses suggested a cutoff of 61 on the TAS-20. This is highly consistent with the cutoff score suggested by (Taylor, 1997), which

has been used in previous literature examining individuals with higher or lower alexithymia (Szatmari et al., 2008). Our work provides more evidence that a TAS-20 score of 61 or greater is a signifier of a clinically significant level of alexithymia.

To our knowledge, this is the first study to evaluate the relationship of alexithymia with response to computerized CBT. As with the parent study (Carroll et al., 2014), the strengths of this report include the use of rigorous clinical trials methodology, including random assignment to treatment condition. Substance use was evaluated at multiple points throughout the trial and during follow-up via urine toxicology screens and self-reports. There was good treatment adherence and a low attrition rate (85% of participants completed all follow-up interviews) which did not differ by treatment condition or alexithymia level and thus facilitated interpretation of the findings.

Several limitations should also be noted. First, the TAS-20 was initiated after the trial began and thus was completed by only 73 of the 101 individuals in the intent-to-treat sample. Second, the overall level of alexithymia was relatively high overall; hence, outcomes might differ among substance users with a different pattern of TAS-20 scores. Third, to fully examine alexithymia's role in different treatment variations, the effectiveness of computerized CBT should also include a comparison with traditional therapist-administered CBT. Finally, it should also be noted that the TAS-20 is a self-report scale. As one of the symptoms of alexithymia is reduced ability to describe emotion, it is worthwhile to consider that the use of the TAS-20 may not have been the most accurate measure of alexithymia. While any such differences should have been taken into account via the use of the same scale across all participants, alexithymia measures that do not rely on subject report (such as the Observer Alexithymia Scale or the Toronto-Structured Interview for Alexithymia) would have strengthened the findings here.

In sum, results suggest that in this population of cocaine-dependent methadone maintained individuals, individuals with higher alexithymia scores appeared to respond comparatively well when assigned to CBT4CBT with respect to treatment as usual. While TAS-20 scores were high in this sample, they did not appear to be significantly associated with more severe levels of current drug use. Alexithymia appeared to be stable throughout treatment. Finally, computerized CBT appeared especially effective in the high-alexithymia sample throughout the duration of treatment. Given the prevalence of alexithymia in cocaine dependence and the difficulties with treatment associated with alexithymia, these findings suggest that computerized CBT may be a valuable resource for treatment of a challenging clinical population.

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Highlights

- Methadone-maintained cocaine abusers have high levels of alexithymia
- Alexithymia does not change over time in this population
- Individuals with high alexithymia respond better to computerized CBT therapy for drug dependence than individuals with low alexithymia

Figure 1.
Interaction of TAS-20 score by treatment group; percent of cocaine-negative urine toxicology screens within treatment; results of ATI analyses

Figure 2.

Frequency of cocaine use by time, TAS-20 alexithymia score (using cut-off of 61), and treatment condition (CBT4CBT (computerized CBT plus TAU versus TAU (treatment as usual) alone).

Table 1

Comparison of TAS-20 alexithymia scores by baseline variables.

Variable	Yes	n	No	n	F or χ^2	P value
Male gender	59.51(6.62)	35	57.10(5.65)	38	2.81	0.98
Employed	56.75(7.00)	8	58.44(6.13)	65	0.52	0.47
Lifetime Alcohol Use Disorder ^a	58.35(6.36)	57	57.93(5.80)	16	0.05	0.81
Current Alcohol Disorder	52.50(2.62)	4	58.59(6.12)	69	3.78	0.06
Lifetime Sedative Disorder	58.76(7.01)	26	57.97(5.77)	47	0.27	0.59
Lifetime Marijuana Disorder	58.96(6.09)	54	56.26(6.24)	19	2.72	0.01
Lifetime Major Depression	57.63(6.70)	22	58.53(6.02)	51	0.32	0.58
Lifetime Anxiety Disorder	57.82(6.06)	23	58.46(6.32)	50	0.16	0.69
Lifetime PTSD	57.27(5.91)	11	58.47(6.33)	61	0.34	0.56

^a indicates psychiatric diagnoses from SCID interviews for DSM-IV diagnoses. TAS-20 scores range from 20 to 80, with higher scores indicative of higher alexithymia. Total degrees of freedom for all analyses were 72.

Table 2

Relationship of continuous baseline demographic variables with baseline TAS-20 total score, simple correlations N=71

Variable	r	p
Age	.01	.90
Years of Regular Alcohol Use	.24	.04
Years of Regular Marijuana Use	.22	.05
Years of Regular Cocaine Use	.24	.04
Years of Regular Opiate Use	.23	.05
Days of alcohol use, past 28	.01	.94
Days of cocaine use, past 28	.05	.70
Days of marijuana use, past 28	.06	.61
Days of nicotine use, past 28	-.01	.91
Days of Heroin use, past 28	-.07	.56
Age first used cocaine	-.15	.20
Methadone dose	.12	.34
Beck Depression Inventory	.29	.01
PANAS		
Positive Affect Scale	-.07	.53
Negative Affect Scale	.09	.42
ERQ		
Cognitive Reappraisal	-.15	.20
Executive Suppression	.08	.48
BSI		
Somatization	.31	.01
Obsessive-Compulsive	.28	.01
Interpersonal Sensitivity	.37	.01
Depression	.27	.02
Anxiety	.32	.01
Hostility	.32	.01
Phobic Anxiety	.37	.01
Paranoid Ideation	.37	.01
Psychoticism	.35	.01

^a Beck Depression Inventory scores range from 0 to 63, with higher scores indicating more current depressive symptoms.

^b PANAS indicates Positive and Negative Affect Schedule scores. Scores on either positive or negative affect can range between 10 and 50, with higher scores indicating higher levels of positive or negative affect.

^c ERQ indicates Emotional Regulation Questionnaire scores, which can be divided into a cognitive reappraisal subscale score (range of scores 6 to 42) and an expressive suppression score (range of scores 4 to 28).

^d BSI indicates Brief Symptom Index scores. Subscale scores in the table range from 0 to 1, with higher scores indicating higher levels of that symptom.

Table 3

Effects of treatment group, baseline TAS-20 score, and primary treatment adherence and outcomes, ATI model with regions of significance

	Group		TAS		Interaction		R ² change due to interaction		Region of Significance	
	t	p	t	p	t	p	R ² change	F	p	N
# Days in Treatment	.77	.44	.79	.43	.80	.42	.01	.64	.42	
Total Individual Sessions	1.02	.31	-.24	.81	1.14	.26	.02			
Total Group Sessions	.55	.58	1.05	.30	.48	.64	.00			
Total WAI-C	.09	.93	-.47	.64	-.07	.95	.00			
Percent Cocaine Negative Urine specimens	2.03	.05	2.40	.02	2.17	.03	.06	4.72	.03	61+
Percent Days Abstinent	1.86	.07	1.87	.07	2.00	.05	.06	4.00	.05	61+
Maximum Consecutive Days of Abstinence	2.09	.04	2.33	.02	2.17	.03	.07	4.59	.03	64.5+

^a WAI-C Indicates the client version of the Working Alliance inventory. The WAI-T indicates the technology version of the Working Alliance Inventory