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DBT-enhanced cognitive-behavioral treatment for trichotillomania: A randomized controlled trial

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Background and aims: Limited treatment options are available for trichotillomania (TTM) and most have modest outcomes. Suboptimal treatment results may be due to the failure of existing approaches to address all TTM styles. *Methods:* Thirty-eight DSM-IV TTM participants were randomly assigned across two study sites to Dialectical Behavior Therapy (DBT) -enhanced cognitive-behavioral treatment (consisting of an 11-week acute treatment and 3-month maintenance treatment) or a minimal attention control (MAC) condition. MAC participants had active treatment after the 11-week control condition. Follow-up study assessments were conducted three and six months after the maintenance period. *Results:* Open trial treatment resulted in significant improvement in TTM severity, emotion regulation (ER) capacity, experiential avoidance, anxiety and depression with changes generally maintained over time. In the randomized controlled trial, those with active treatment had greater improvement than those in the MAC condition for both TTM severity and ER capacity. Correlations between changes in TTM severity and ER capacity were not reported at post-treatment but did occur in maintenance and follow-up indicating reduced TTM severity with improved ER capacity. *Conclusions:* DBT-enhanced cognitive-behavioral treatment is a promising treatment for TTM. Future studies should compare this approach to other credible treatment interventions and investigate the efficacy of this approach in more naturalistic samples with greater comorbidity.

Keywords: trichotillomania, hair pulling, cognitive-behavioral treatment, dialectical behavior therapy

INTRODUCTION

Meta-analytic research (Bloch et al., 2007) and expert clinician consensus (Flessner, Penzel, Trichotillomania Learning Center Scientific Advisory Board & Keuthen, 2010) have identified cognitive-behavioral treatment as the first-line treatment intervention for trichotillomania (TTM). Despite evidence for acute benefit for TTM with cognitive-behavioral treatment, concerns regarding inadequate treatment response and symptom relapse post-treatment continue to overshadow the field.

Failure to achieve greater, and more enduring, symptom reduction with traditional Habit Reversal Training (Azrin & Nunn, 1973; Azrin, Nunn & Frantz, 1980) has been hypothetically attributed to its failure to address uncomfortable inner experiences that trigger TTM. More specifically, some TTM experts have proposed that habit reversal training is successful in treating more habitual pulling through awareness enhancement and instruction in the use of alternate motor routines, but fails to address the pulling related to intense emotions or sensory experiences (e.g., Flessner et al., 2008; Keuthen et al., 2010; Woods, Wetterneck & Flessner, 2006).

Woods and colleagues have explored the relationship between experiential avoidance and TTM and the efficacy of Acceptance and Commitment Therapy (ACT)-enhanced habit reversal training for treating this disorder. In an anonymous Internet survey, Begotka, Woods and Wetterneck (2004) demonstrated that individuals with greater experiential avoidance had more severe hair pulling. Subsequent research by this group showed that experiential avoidance can mediate relationships between hair pulling severity and fear of negative evaluation, beliefs about appearance, and shame-related cognitions (Norberg, Wetterneck, Woods & Conelea, 2007). A multiple baseline study of ACT-enhanced habit reversal training revealed significant reduction in hair pulling severity with self-monitored pulling frequency, self-rated pulling severity and social validity ratings (Twohig & Woods, 2004). Additionally, reductions in experiential avoidance were significantly associated with reductions in hair pulling severity at 3-month follow-up. Woods et al. (2006) subsequently conducted a randomized controlled trial comparing a 10-week trial of ACT-enhanced habit reversal training with a waitlist control for TTM. The treatment group demonstrated significantly greater reductions in hair pulling severity and impairment, experiential avoidance, anxiety and depression than the waitlist control group. Symptom improvement was largely maintained at 3-month follow-up. Decrease in experiential avoidance was significantly correlated with reduction in pulling severity.

Our research group has been active in exploring the role of affective dysregulation in TTM (Shusterman, Feld, Baer

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& Keuthen, 2009) and the potential treatment efficacy of Dialectical Behavior Therapy (DBT)-enhanced habit reversal training (Keuthen et al., 2010, 2011). Our findings from a large Internet survey of TTM demonstrated that hair pullers had more difficulty than normal controls in managing their emotions, with a small to moderate relationship between affective regulation and hair pulling severity (Shusterman et al., 2009). Additionally, using latent class analysis, we identified four subtypes consisting of unique emotional profiles and demonstrated that cluster membership predicted hair pulling severity.

In our earlier paper (Keuthen et al., 2010), we summarized the extant literature documenting the potential role of affective variables in TTM. Recognizing the successful use of DBT (Linehan, 1993a, 1993b) for other disorders characterized by affective dysregulation and impulsivity, we developed a novel treatment approach for TTM augmenting traditional habit reversal training with DBT techniques. DBT is based upon fundamental behavioral principles, and incorporates many traditional cognitive and behavioral interventions. However, it also includes skills to address impulsivity and difficulty tolerating aversive experiences, with modules on mindfulness, emotion regulation (ER), and distress tolerance. Although DBT and ACT share some common conceptual underpinnings, we chose to enhance traditional habit reversal training with DBT strategies for several reasons. First, DBT is less conceptually abstract than ACT and arguably offers more specific skills instruction for specific treatment targets. Additionally, learning new theoretical background is not necessary for the implementation of DBT by experienced cognitive-behavioral therapists. Lastly, compelling anecdotal evidence from both clinicians and individuals with TTM has suggested the incremental benefit of augmenting traditional treatment approaches for TTM with DBT skills.

In a pilot open treatment trial of DBT-enhanced habit reversal training for TTM, we demonstrated significant improvement in hair pulling severity/impairment, ER and anxiety and depressive symptoms at both post-treatment and 3-month maintenance (Keuthen et al., 2010). Expected correlations between ER capacity and hair pulling severity were demonstrated during both acute and maintenance treatment. At 3- and 6-month follow-up after the 3-month maintenance period, significant improvement from baseline still occurred for all hair pulling severity and ER measures (Keuthen et al., 2011). At both follow-up time points, significant correlations were reported between changes in hair pulling severity and ER capacity.

To more rigorously evaluate the efficacy of DBT-enhanced treatment (herein referred to as "DBT-enhanced cognitive-behavioral treatment") for TTM, we conducted a randomized controlled trial comparing our augmented treatment with a minimal attention control (MAC) comparison condition. After acute treatment, participants had 4 maintenance sessions over the following 3 months. Follow-up assessments occurred 3 and 6 months after maintenance treatment with no therapist contact during this time. Participants initially randomized to the control condition subsequently received active treatment.

In this study we had several specific hypotheses and also conducted additional exploratory analyses. First, we expected significant pre- to post-treatment improvement for participants in active treatment on all hair pulling and ER variables, as well as mood and anxiety. Secondly, we predicted maintenance of treatment benefit with no significant differences for any time point comparisons between post-treatment and 6-month follow-up. Thirdly, for the randomized controlled trial, we anticipated significantly greater improvement after acute treatment on all hair pulling and ER variables, as well as mood and anxiety, for the DBT-enhanced cognitive-behavioral treatment vs. MAC participants. Lastly, we anticipated an inverse correlation between changes in hair pulling severity and ER capacity such that reductions in hair pulling severity would be correlated with improvement in ER capacity from pre-treatment to post-treatment, and maintained from post-treatment to all subsequent time points after post-treatment.

In addition to these planned aims, we examined changes in experiential avoidance as a mechanism for change in hair pulling severity throughout treatment and follow-up given earlier findings from other researchers. Lastly, we investigated self-report of consumer satisfaction.

METHODS

Participants

Thirty-eight participants (31 female, 7 males) with DSM-IV TTM were enrolled in the study across two sites (MGH/Harvard, Emory). Participants were randomly assigned to the DBT-enhanced cognitive-behavioral treatment (n = 20) and MAC (n = 18) study conditions.

Potential participants were preliminarily phone screened to assess for satisfaction of study criteria. Inclusion criteria consisted of a primary DSM-IV TTM diagnosis; ≥ 18 years of age; a minimum MGH-HPS total scale score of 10; and a minimum TTM symptom duration of 1 year with no significant remissions (as defined by complete abstinence of hair pulling for a 2-week period during the prior 6 months). All participants were able to provide informed consent and had sufficient intellectual capacity to accurately complete self-report measures. Exclusion criteria entailed the presence of a serious psychiatric condition including mental retardation, psychosis, pervasive developmental disorder, organic mental disorders, manic episode, ADHD, suicidality; alcohol or substance abuse within the past 3 months; the presence of a serious medical condition that would limit ability to routinely attend sessions and complete homework assignments; involvement in other psychotherapy for TTM; prior cognitive-behavioral treatment for TTM; prior DBT; and changes in psychotropic medications within 2 months of baseline assessment. Individuals on stable psychotropic medications were enrolled as long as they had no plans to change medication during the study.

Eligible participants were scheduled for an in-person interview with an independent assessor (IA). All IAs had a minimum of a masters-level degree and received training in structured assessment interviews by the PI (NJK or BOR) at their respective site. The baseline evaluation included administration of several semi-structured interviews for diagnosis, TTM history, and TTM symptom profile, as well as completion of patient self-report scales. Eligible participants were enrolled upon completion of the IA interview. The PI at the alternate site reviewed taped assessments to establish rating reliability.

The study was registered with ClinicalTrials.gov (NCT00740909) and IRB approval was obtained at each study site prior to study initiation. Informed consent was obtained from all subjects after study procedures were ex-

plained and prior to study participation. This research also complied with the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Assessment measures

Our assessment battery included clinician-administered semi-structured interviews for psychiatric diagnosis, TTM history, TTM symptom severity and impairment, and global improvement. Self-report scales were also utilized to assess TTM severity, mood and anxiety symptoms, ER capacity, and experiential avoidance. Completion of all baseline study assessment measures required 1 ½ to 2 hours for most participants. Participants were also asked to complete ratings of consumer satisfaction upon study completion.

Our study battery included the following:

Clinician-administered instruments

A) Psychiatric diagnosis

Structured Clinical Interview for DSM-IV Axis I Disorders–Patient Edition (SCID-P): The SCID-P (First, Spitzer, Gibbon & Williams, 1995) is a structured interview with acceptable psychometric properties that is the standard for psychiatric diagnosis. It was used to assess comorbid psychiatric diagnoses and exclusionary disorders.

Trichotillomania Diagnostic Interview–Revised (TDI-R): The TDI (Rothbaum & Ninan, 1994) is a semi-structured interview modeled after the SCID consisting of 3-point ratings of items assessing the DSM-III-R TTM diagnostic criteria. The TDI was revised to ensure conformity with DSM-IV criteria. (To wit, we changed Item #4 to state "Do you experience an increasing sense of tension before pulling out the hair, or when attempting to resist the behavior?" We also added the question "Does your hair pulling cause you significant distress or impairment in social, occupational, or other important areas of functioning?") The TDI-R was used to establish the diagnosis of TTM for all study participants.

ADHD Module of the Schedule for Affective Disorders and Schizophrenia for School-Age Children–Epidemiologic Version (KSADS-E): The ADHD module of the KSADS-E (Orvaschel, 1985) is a structured interview used to diagnose ADHD. All scale items were worded in both the present and past tense for our study. Adult ADHD was diagnosed if: 1) full DSM-IV criteria were met by the age of 7 years old, 2) a chronic symptom course occurred from childhood to adulthood, and 3) a moderate or severe level of impairment from ADHD symptoms was currently endorsed (i.e., ADHD CGI ≥ 4).

B) TTM history

Psychiatric Institute Trichotillomania Scale (PITS): The PITS (Winchel et al., 1992) is a semi-structured guided interview that assesses disorder onset, course, and pulling sites. Interrater agreement is generally acceptable for scale items and concurrent validity has been demonstrated between item scores and self-reported indices of TTM severity.

C) TTM severity and impairment

NIMH Trichotillomania Severity Scale (NIMH-TSS): The NIMH-TSS (Swedo et al., 1989) is a clinician-rated scale assessing pulling frequency (both on the previous day and during the past week), urge intensity, urge resistance, subjective distress, and interference with daily activities. Items are rated from 0 (none) to 5 (most severe). This scale has reported sensitivity to changes in symptom severity, adequate to excellent interrater reliability, and good concurrent validity with self-reported measures of TTM severity.

NIMH Trichotillomania Impairment Scale (NIMH-TIS): The NIMH-TIS (Swedo et al., 1989) is a clinician-rated scale with possible scores ranging from 0 (absent) to 10 (severe). Ratings are based on severity of alopecia, time spent pulling or hiding damage, ability to control pulling, interference, and incapacitation. Psychometric data are limited, though inter-rater reliability scores have ranged from adequate to excellent, good concurrent validity has been reported, and scale scores are sensitive to changes in symptom severity with treatment.

D) Global improvement

Clinical Global Improvement Scale (CGI): The CGI (Guy, 1976) is a 7-point Likert scale frequently utilized to measure improvement in clinical trials. Scores range from 1 (very much improved) to 7 (very much worse). CGI ratings by the IAs were used to determine treatment responder status.

Self-report instruments

A) TTM severity

Massachusetts General Hospital Hairpulling Scale (MGH-HPS): The MGH-HPS (Keuthen et al., 1995) is a self-report instrument for the assessment of TTM severity. It consists of seven items including frequency and intensity of urges, ability to control urges, frequency of hair pulling, resistance to and control over hair pulling, and associated distress. Items are rated on a severity scale ranging from 0 to 4. It is a homogeneous scale with good internal consistency. Scale evaluation with an independent sample documents its test–retest reliability, convergent and divergent validity, and sensitivity to change in symptoms.

B) ER capacity

Difficulty in Emotion Regulation Scale (DERS): The DERS (Gratz & Roemer, 2004) is a 36-item self-report instrument based on a multidimensional conceptualization of ER. It has six subscales measuring awareness, clarity, and non-acceptance of emotional responses, limited strategies for emotion regulation with perceived efficacy, and difficulties with impulse control and goal-directed behavior when experiencing negative emotions. Preliminary data indicate high internal consistency, good test–retest reliability and adequate construct and predictive validity. Lower scores reflect greater emotion regulation capacity.

Generalized Expectancy for Negative Mood Regulation Scale (NMR): The NMR (Catanzaro & Mearns, 1990) is a 30-item self-report scale used to assess expectations that specific behaviors or cognitions will alleviate a negative mood state. Items are rated on a 5-point scale ranging from 1 (strong disagreement) to 5 (strong agreement). High internal consistency coefficients, discriminant validity from social desirability, and temporal stability have been reported. Higher scores reflect greater expected capacity to regulate emotions.

Affective Regulation Rating (ARR): The ARR is a 5-point Likert scale designed for this study to measure perceived ability to modulate TTM-related mood states. We developed this instrument out of concern that existing ER measures may be insufficient to target the unique emotion regulation difficulties individual hair pullers may experience. Individuals are instructed to review a list of twelve moods (including bored, angry, guilty, indifferent, happy, calm, tense, irritable, sad, anxious, relieved, and ashamed) and identify the 3 moods most likely to have triggered their TTM during the prior week. They then rate their ability to modulate those moods from 1 (not at all able) to 5 (completely able).

C) Mood and anxiety

Beck Depression Inventory-II (BDI-II): The BDI-II (Beck, Steer & Brown, 1996) is a 21-item self-report inventory that assesses the severity of depression. It is an updated version of the original BDI with item content matched to DSM-IV criteria for a major depressive episode. The BDI-II has high internal consistency and evidence for construct validity includes elevated BDI-II scores in psychiatric outpatient samples.

Beck Anxiety Inventory (BAI): The BAI (Beck, Epstein, Brown & Steer, 1988) is a 21-item self-report inventory designed to assess anxiety severity. The BAI is reported to have high internal consistency and its one-week test–retest reliability is satisfactory.

D) Experiential avoidance

Acceptance and Action Questionnaire (AAQ): The AAQ (Hayes et al., 2004) is a 9-item instrument used to measure experiential avoidance. It has documented internal consistency, as well as good convergent, divergent and discriminant validity. Lowered scores on this measure indicate less avoidance of uncomfortable private events.

E) Consumer satisfaction

Consumer Satisfaction Form (CSF): The CSF is a 4-item self-report scale developed for this study to assess treatment satisfaction, condition status, change in condition and extent to which change is perceived to be treatment-related. For the first three items, response scores ranged from 1 (very satisfied/excellent/much better) to 7 (very dissatisfied/extremely poor/much worse). Ratings for perceived condition change related to treatment ranged from 1 (definitely related) to 5 (definitely not related).

Procedures

Participants randomized to the treatment arm of the study received 11 weekly 50-minute acute treatment sessions. Study therapists delivered a manualized treatment protocol developed by study authors (NJK, BOR, SSW) that was previously studied in our open treatment pilot study. The treatment encompassed standard habit reversal training and stimulus control techniques augmented with DBT strategies deemed to be relevant to TTM. The DBT techniques adopted for this treatment were tailored to specifically address TTM. The session content format for the acute treatment protocol included: Session 1: Psychoeducation, motivational interviewing, chain analysis and self-monitoring; Session 2: Competing response, stimulus control procedures and prevention training; Sessions 3–5: Mindfulness training; Sessions 6–8: Emotion regulation training; Sessions 9–10: Distress tolerance training; and Session 11: Relapse prevention training. Subsequent maintenance treatment (Sessions 12–15) had an emphasis on relapse prevention and review of prior techniques. (For further description of the treatment protocol, please refer to Keuthen et al. [2010].)

The first treatment session was scheduled within 1 week of the baseline assessment. After the acute treatment was completed, participants had 4 booster sessions over the following 3 months (at 2, 4, 8 and 12 weeks post-treatment). Study therapists were trained in protocol delivery by their site PI.

All study sessions were videotaped for supervision as well as treatment integrity ratings by the alternate site PI. Ten percent of all study tapes (both MAC and treatment sessions) were rated for adherence and competence. Treatment integrity coding was based on an adaptation of the Nishith and Resick (1994) rating system. Ratings were made for protocol adherence (presence/absence) and competence (1 [very poor] to 7 [excellent]). Tapes were rated as 99% adherent for the treatment sessions and 100% adherent for the MAC sessions. Mean therapist skill ratings for the acute treatment sessions were 6.59 (SD = 0.43) for the unique and essential elements of the protocol and 6.76 (SD = 0.27) for the essential but not unique elements of the protocol. Mean therapist ratings for the MAC sessions were 6.83 (SD = 0.35) for the unique and essential elements of the protocol and 6.71 (SD = 0.52) for the essential but not unique elements of the protocol.

The MAC condition was designed to control for time, therapist contact and repeat assessments. We did not choose another credible treatment (e.g., medication, habit reversal treatment alone or ACT-enhanced habit reversal training) for the comparison condition as we first wanted to investigate if: 1) our augmented treatment resulted in maintenance of gains at follow-up (which has generally not been the case for habit reversal treatment alone) and 2) whether changes in hair pulling severity were correlated with changes in emotion regulation capacity during and after treatment. Participants assigned to this study arm received a weekly phone call from the study therapist to assess general functioning, safety, occurrence of stressors and medication use. Therapists did not inquire about hair pulling status or provide advice if asked by the participant. Upon completion of the MAC condition, all participants then received the active treatment protocol.

Follow-up IA assessments occurred at 3 and 6 months after completion of maintenance treatment. Similar evaluations were conducted at these time points to those performed at baseline, post-treatment and 3-month maintenance.

RESULTS

Study sample

See Table 1 for the demographic and clinical profiles of study participants. Our sample consisted largely of young female adults with college degrees or graduate school education. Illness onset was generally in early adolescence with a lengthy duration of illness. Baseline TTM severity was in the moderate range with mild to moderate severity of associ-

Table 1. Baseline descriptive statistics for demographic and clinical variables for all study participants (n = 38)

Demographics	
Age (yrs)	30.71 (8.55)
Female, *n* (%)	31 (81.60)
Education, *n* (%)	
HS grad/GED	6 (15.8)
Associates or technical degree	2 (5.3)
College graduate	17 (44.7)
Graduate school	12 (31.6)
Illness onset (age)	13.58 (5.70)
Duration of illness (yrs)	17.13 (8.49)
Hair pulling severity	
MGH-HPS	17.42 (3.41)
NIMH-TSS	16.16 (3.67)
Hair pulling impairment	
NIMH-TIS	6.79 (1.04)
Emotion regulation	
ARR	7.79 (1.56)
DERS total	77.39 (19.83)
NMR total	106.55 (11.45)
Experiential avoidance	
AAQ	34.34 (7.70)
Mood and anxiety	
BDI-II	9.38 (6.41)
BAI	5.51 (4.86)

ated functional impairment. Mood and anxiety symptoms were non-clinical in severity.

Participants randomized to the DBT-enhanced cognitive-behavioral treatment condition (n = 20) did not significantly differ (p > .05) from those in the MAC condition (n = 18) with the exception of gender (X^2 = 5.06, p = .02). The treatment arm had 19 females and 1 male while the MAC condition had 12 females and 6 males. Current comorbidity for the DBT-enhanced cognitive-behavioral treatment group included GAD (n = 1) and anxiety NOS (n = 1). Current comorbidity for the MAC group included social phobia (n = 1) and anxiety NOS (n = 1). Lifetime comorbidity for the DBT enhanced cognitive-behavioral treatment group included MDD (n = 6), substance-induced mood disorder (n = 1), anxiety NOS (n = 1), bulimia (n = 1) and Tourette's disorder (n = 1). Lifetime comorbidity for the MAC group included MDD (n = 7), depression NOS (n = 1), alcohol abuse (n = 1), alcohol dependence (n = 1), cannabis abuse (n = 1), panic disorder (n = 1), social phobia (n = 1), specific phobia (n = 1), anxiety NOS (n = 1) and bulimia (n = 1). Current psychotropic medications reported for the DBT-enhanced cognitive-behavioral treatment group were n-acetyl cysteine (n = 1) and zolpidem (n = 1) and for the MAC group were sertraline (n = 1), venlafaxine (n = 1), zolpidem (n = 1) and alprazolam (n = 1). No medication changes were reported during acute treatment. One participant reported a 10-day hiatus in her sertraline only during the last month of the maintenance treatment.

During the randomized controlled trial, there were two dropouts (both initially randomized to active treatment). Upon completion of the randomized controlled trial, all MAC participants received the treatment protocol; three of these participants dropped out before completing acute treatment. Additional participants subsequently dropped out during 3-month maintenance (n = 1), 3-month follow-up (n = 1) and 6-month follow-up (n = 1). Comparison of completers through 3-month maintenance treatment (n = 32) with dropouts (n = 6) did not reveal significant group differences (p >. 05) on demographics (age, illness onset, illness duration, gender, education), hair pulling severity or impairment, mood and anxiety or experiential avoidance. For ER capacity, completers did not differ from dropouts on DERS total or NMR total scores; on the ARR, dropouts had significantly higher baseline ER scores than completers indicating a greater ability to control mood states that trigger hair pulling.

Efficacy of DBT-enhanced cognitive-behavioral treatment for TTM

Tests of normality and visual inspection of residual plots provided evidence for non-normal distributions for several study variables. Accordingly, we chose non-parametric analyses to investigate treatment outcome.

See Table 2. Pre- to post-treatment Wilcoxon signed ranks paired samples tests for all participants during DBT-enhanced cognitive-behavioral treatment revealed signifi-

Table 2. Means and standard deviations for all variables at each study time point during the open treatment trial

	Pre-treatment (n = 38)	Post-treatment (n = 33)	3-month maintenance (n = 32)	3-month follow-up (n = 30)**	6-month follow-up (n = 30)
Hair pulling					
MGH-HPS	16.71 ± 4.04[a,b,c,d]	7.30 ± 4.03[f,g]	7.09 ± 4.64[h,i]	8.93 ± 3.44	8.83 ± 4.51
NIMH-TSS	15.71 ± 3.49[a,b,c,d]	6.06 ± 4.64	5.59 ± 5.36	6.33 ± 4.65	6.93 ± 4.70
NIMH-TIS	7.11 ± 1.52[a,b,c,d]	4.67 ± 2.17[e]	3.41 ± 2.61	3.67 ± 2.45	3.63 ± 2.63
Emotion regulation					
ARR*	7.82 ± 1.69[a,b,c,d]	11.12 ± 2.30	11.59 ± 2.03	11.03 ± 2.17	10.76 ± 2.40
DERS total	74.68 ± 18.52	71.15 ± 19.13	68.28 ± 17.40	67.90 ± 17.69	68.45 ± 16.58
NMR total*	107.08 ± 12.18[a,b,d]	111.42 ± 13.99	113.03 ± 12.81	110.38 ± 15.97	111.93 ± 14.20
Experiential avoidance					
AAQ	32.84 ± 6.97[a,b,c,d]	30.79 ± 7.20	29.81 ± 7.39	29.59 ± 7.73	29.17 ± 7.72
Depression and anxiety					
BDI	7.00 ± 5.88[a,b,c,d]	4.58 ± 6.06	3.47 ± 4.91	4.44 ± 5.75	3.52 ± 4.47
BAI	5.14 ± 4.83[a,b,c,d]	3.55 ± 7.47	2.26 ± 2.61	2.75 ± 4.77	2.89 ± 3.84

* Higher scores reflect better functioning.

** Missing data for 1 participant at 3-month follow-up.

[a] $p \leq .05$ (pre-tx, post-tx), [b] $p \leq .05$ (pre-tx, 3-mo maintenance), [c] $p \leq .05$ (pre-tx, 3-mo f-u), [d] $p \leq .05$ (pre-tx, 6-mo f-u), [e] $p \leq .05$ (post-tx, 3-mo maintenance), [f] $p \leq .05$ (post-tx, 3-mo f-u), [g] $p \leq .05$ (post-tx, 6-mo f-u), [h] $p \leq .05$ (3-mo maintenance, 3-mo f-u), [i] $p \leq .05$ (3-mo maintenance, 6-mo f-u).

cant improvement in both TTM severity (MGH-HPS total: $Z = 5.02$, $p < .001$; NIMH-TSS: $Z = 5.02$, $p < .001$) and impairment (NIMH-TIS: $Z = 4.40$, $p < .001$). Pre- to post-treatment improvement in ER capacity was reported (ARR: $Z = 4.43$, $p < .001$; NMR total: $Z = 3.44$, $p = .001$). Subsequent analysis of NMR subscale scores revealed significant pre- to post-treatment improvement on the NMR general ($Z = 2.92$, $p < .01$), cognitive ($Z = 2.08$, $p = .04$), and behavioral ($Z = 3.69$, $p < .001$) subscale scores. No significant changes in DERS scores occurred from pre- to post-treatment. Significant improvement was also reported in experiential avoidance (AAQ: $Z = 2.38$, $p = .02$), depression (BDI: $Z = 2.83$, $p < .01$) and anxiety (BAI: $Z = 3.56$, $p < .001$).

Maintenance of improvement with DBT-enhanced cognitive-behavioral treatment for TTM

No significant changes in ER capacity, experiential avoidance, depression or anxiety occurred for any time point comparison between post-treatment and 6-month follow-up. Significant improvement for these variables was still reported from pre-treatment to 3-month maintenance, 3-month follow-up and 6-month follow-up (with the exception of the non-significant change in NMR total scores from pre-treatment to 3-month follow-up).

There were, however, some significant changes in hair pulling severity and impairment from post-treatment to later time points. MGH-HPS scores worsened slightly from post-treatment to 3- and 6-month follow-up and from 3-month maintenance to 3- and 6-month follow-up. Conversely, significant improvement in TTM impairment was reported for the TIS from post-treatment to 3-month maintenance. Despite the changes noted above, significant improvement on all TTM variables was still reported for time point comparisons between pre-treatment and 3-month maintenance, 3-month follow-up and 6-month follow-up.

Comparison of DBT-enhanced cognitive-behavioral treatment to MAC during acute treatment of TTM

See Table 3. Mann–Whitney U independent samples *t*-tests comparing DBT-enhanced cognitive-behavioral treatment and MAC completers on baseline to week 11 change scores revealed group differences in hair pulling severity (MGH-HPS: $U = 23.50$, $p < .001$; NIMH-TSS: $U = 28.00$, $p < .001$) and impairment (NIMH-TIS: $U = 50.00$, $p < .001$). The two groups were also significantly different on change in ER capacity on the ARR ($U = 42.50$, $p < .001$) but not on the DERS or NMR total scores. Greater improvement on hair pulling and ER measures was consistently reported for the DBT-enhanced cognitive-behavioral treatment vs. MAC study conditions. The two groups were not significantly different pre- to post-treatment in experiential avoidance, depression or anxiety scores.

Baseline to week 11 Wilcoxon signed ranks paired samples *t*-tests for DBT-enhanced cognitive-behavioral treatment participants only in the randomized controlled trial revealed significant improvement for hair pulling severity/ impairment (MGH-HPS total, NIMH-TSS, NIMH-TIS), ER capacity (ARR, NMR total), depression (BDI) and anxiety (BAI). Subsequent analysis revealed significant improvement on all NMR subscales. For participants in the MAC condition, baseline to week 11 paired samples *t*-tests failed to yield significant improvements on all hair pulling and ER measures; however, analyses did reveal significant improvements on the AAQ and BDI indicating lowered experiential avoidance and fewer depressive symptoms at week 11.

Total abstinence from hair pulling was reported for 5 DBT-enhanced cognitive-behavioral treatment participants and 1 MAC participant at week 11. [Total abstinence was defined by a score of "0" on both MGH-HPS items #4 (frequency of hair pulling) and #6 (control over hair pulling]. Full responders (CGI $\leq$ 2 and $\geq$ 35% decrease in MGH-HPS total scores) at week 11 included 11 DBT-enhanced cognitive-behavioral treatment participants and 1 MAC participant.

Relationship between ER capacity and AAQ with hair pulling measures at baseline

Evidence for non-normal bivariate distributions led us to use non-parametric statistics to examine baseline relationships between hair pulling measures and both ER capacity and experiential avoidance. No significant Spearman's rho correlations ($p > .05$) were reported at baseline between ER measures or experiential avoidance and hair pulling measures.

Table 3. Means and standard deviations at baseline and 11 weeks for completers in the DBT-enhanced cognitive-behavioral treatment (CBT) and MAC study conditions

	DBT-enhanced CBT ($n = 18$)		MAC ($n = 18$)	
	Baseline	11 weeks	Baseline	11 weeks
Hair pulling				
MGH-HPS total*	18.10 ± 2.97	7.72 ± 3.75	16.67 ± 3.79	15.17 ± 4.57
NIMH-TSS*	17.15 ± 3.41	7.00 ± 4.92	15.06 ± 3.73	14.11 ± 2.89
NIMH-TIS*	6.85 ± 0.93	5.22 ± 1.86	6.72 ± 1.18	6.67 ± 1.19
Emotion regulation				
ARR*	7.65 ± 1.81	11.67 ± 2.22	7.94 ± 1.26	8.00 ± 1.57
DERS total	73.75 ± 21.95	72.28 ± 21.88	81.44 ± 16.86	75.72 ± 14.35
NMR total	109.40 ± 13.18	114.11 ± 16.05	103.39 ± 8.43	104.50 ± 10.75
Experiential avoidance				
AAQ	33.45 ± 7.69	31.28 ± 8.24	35.33 ± 7.81	32.17 ± 6.20
Depression and anxiety				
BDI	8.15 ± 5.31	4.83 ± 6.45	10.82 ± 7.40	5.72 ± 6.35
BAI	5.50 ± 5.37	2.28 ± 3.12	5.53 ± 4.35	4.67 ± 4.15

*$p < .05$ for independent samples *t*-tests comparing group differences from baseline to 11 weeks.

Relationship between changes in ER capacity and AAQ with changes in TTM measures with treatment

No significant correlations were reported for the entire sample from pre- to post-treatment between changes in ER and TTM measures. From pre-treatment to 3-month maintenance, changes in DERS total scores were significantly correlated with changes in both MGH-HPS total scores (r_S = .45, p = .01) and NIMH-TIS scores (r_S = .44, p = .01). Subsequent analyses revealed significant correlations between changes in DERS non-acceptance subscale scores and changes in MGH-HPS total (r_S = .35, p = .05) and NIMH-TSS (r_S = .37, p = .04) scores. Changes in DERS awareness subscale scores were correlated with changes in NIMH-TIS scores (r_S = .50, p < .01). Changes in DERS clarity subscale scores and NIMH-TIS scores were significantly correlated (r_S = .44, p = .01). Marginal correlations (.05 < p < .10) were reported for changes in DERS total and NIMH-TSS scores, changes in ARR and MGH-HPS total scores, and changes in DERS goals and MGH-HPS total scores. In all instances, improved ER capacity was correlated with reduced TTM severity or impairment.

From pre-treatment to 3-month follow-up, changes in ARR scores were significantly correlated with changes in MGH-HPS total scores (r_S = –.40, p = .03) and NIMH-TSS scores (r_S = –.40, p = .03). The correlation between ARR scores and NIMH-TIS scores was marginally significant. In all instances, improved ER capacity was correlated with reduced TTM severity or impairment.

From pre-treatment to 6-month follow-up, changes in ARR scores were significantly correlated with changes in MGH-HPS total scores (r_S = –.61, p < .001), NIMH-TSS scores (r_S = –.46, p = .01), and NIMH-TIS scores (r_S = –.47, p < .01). Changes in NMR total scores were also significantly correlated with changes in MGH-HPS (r_S = –.42, p = .02) and NIMH-TIS (r_S = –.39, r = .04) scores. Subsequent analyses of correlations between NMR subscale and TTM scores indicated significant correlations between changes in NMR cognitive subscale and NIMH-TIS scores (r_S = –.45, p =.02). Marginally significant correlations were reported between changes in both NMR general and cognitive subscale scores and changes in MGH-HPS total scores. In all instances, improved ER capacity was correlated with reduced TTM severity or impairment.

Changes in AAQ scores were correlated with changes in NIMH-TSS (r_S = .40, p = .03) and NIMH-TIS (r_S = .52, p < .01) scores only at 6-month follow-up. Reduced experiential avoidance was correlated with reduced TTM severity and impact.

Consumer satisfaction with DBT-enhanced cognitive-behavioral treatment

On the CSF, treatment satisfaction ratings ranged from "moderately satisfied" to "very satisfied" (post-treatment: M = 1.24, SD = 0.50; 3-month maintenance: M = 1.20, SD = 0.41; 3-month follow-up: M = 1.75, SD = 0.75; 6-month follow-up: M = 1.62, SD = 0.77). Ratings of current condition ranged from "good" to "excellent" (post-treatment: M = 2.15, SD = 1.00; 3-month maintenance: M = 1.96, SD = 0.89; 3-month follow-up: M = 2.67, SD = 0.98; 6-month follow-up: M = 2.92, SD = 1.19). Ratings of condition change largely ranged from "somewhat better" to "much better" (post-treatment: M = 1.42, SD = 0.56; 3-month maintenance: M = 1.36, SD = 0.64; 3-month follow-up: M = 2.00, SD = 0.85; 6-month follow-up: M = 2.08, SD = 0.76). Ratings of treatment-related condition status ranged from "probably related" to "definitely related" (post-treatment: M = 1.12, SD = 0.33; 3-month maintenance: M = 1.40, SD = 0.96; 3-month follow-up: M = 1.50, SD = 0.90; 6-month follow-up: M = 1.69, SD = 0.95).

DISCUSSION

Our open treatment trial results demonstrated significant improvement in TTM severity and impairment, emotion regulation capacity, experiential avoidance, and mood and anxiety with our DBT-enhanced cognitive-behavioral treatment protocol. These improvements largely maintained throughout 6-month follow-up. Although there was some loss of gains following treatment on our self-report instrument of TTM severity, participants remained significantly improved from pre-treatment to all time points after post-treatment.

Our randomized controlled trial results demonstrated greater improvement in TTM severity and impairment for participants in our active treatment vs. MAC conditions. Our treatment group notably demonstrated greater improvement in ER capacity over the MAC group on only one ER measure (the ARR). This finding is consistent with Shusterman et al.'s (2009) argument that more idiographic assessment of ER difficulties is warranted for hair pullers. Existing measures (e.g., the DERS and NMR) globally assess affect regulation with an emphasis on depression and anxiety, failing to assess the full range of emotional triggers potentially related to TTM (e.g, omits boredom). For this reason, we designed the ARR to evaluate emotion regulation in TTM. We included both the DERS and NMR given that it was unclear from our earlier pilot findings whether they measured the same ER construct. Not unexpectedly, we found different correlations for these two measures with other variables throughout the study. Future research should more fully examine the structure and relationship of these ER measures as well as develop assessment tools that better capture ER in this disorder. In a similar vein, it is also important to explore whether the AAQ is the best measure of experiential avoidance in TTM, as well as examine the relationships between experiential avoidance and ER in this disorder.

The MAC and active treatment conditions did not differ from baseline to week 11 on mood, anxiety or experiential avoidance. For the treatment group alone, significant improvement in ER capacity (on both the ARR and NMR), plus depression and anxiety, was demonstrated from baseline to week 11. Unexpectedly, though, significant improvement was also demonstrated for the MAC group for both experiential avoidance and depression from baseline to week 11, suggesting that MAC was not an inert control condition. It is possible that a weekly, albeit brief, open-ended phone inquiry ("How was your week?") may positively impact mood and lower experiential avoidance through the mechanisms of social support and/or awareness enhancement.

It is of interest that no significant correlations between ER capacity (or experiential avoidance) and TTM measures were reported at baseline. Limited affective comorbidity in our sample may have hampered our ability to document this relationship. One might also postulate that lack of emotional awareness at baseline may limit one's ability to accurately assess ER capacity. The increased number of correlations re-

ported between ER capacity and TTM at later study time points may reflect the maturation of affect regulation skills, including emotional awareness, with increased study participation. Future psychopathology research in TTM should examine awareness of affective experiences and the trajectory of affective triggers over time.

It is important to recognize limitations to our study. Our enrollment criteria yielded a study sample with reduced comorbid psychiatric illness, few participants on psychotropic medications, and no hair pullers with prior DBT or cognitive-behavioral treatment for TTM. It is always a challenge in designing initial investigations of novel treatments to balance internal and external validity. As an initial step to investigate our protocol, we decided to control for those variables that we anticipated might mitigate our ability to demonstrate efficacy with our treatment. Alternatively, one could argue that more robust findings related to change in ER capacity with treatment, and correlations between change in ER capacity and TTM severity, might have occurred if there had been a greater range in affective symptom severity in study participants. Future studies should examine our treatment protocol in TTM samples with greater affective comorbidity.

Similarly, our choice of MAC as the control condition does not shed light on how our DBT-enhanced cognitive-behavioral protocol would fare when compared to other treatments with some empirical evidence of efficacy. Thus, future studies should compare our treatment intervention to other active treatment comparison conditions (e.g., habit reversal training alone, ACT-enhanced habit reversal training and psychopharmacological treatments) in larger-scale investigations. Additionally, our study design does not allow us to identify the treatment element(s) responsible for symptom improvement nor can we draw conclusions regarding the number of treatment sessions necessary for change. Future dismantling studies and investigations comparing interventions of varying duration will help to address these important issues. Lastly, researchers should also investigate the ability to disseminate our treatment to community treatment providers and its effectiveness in community samples.

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