Evaluating the Efficacy of Habit Reversal: Comparison With a Placebo Control

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Background: The purpose of this study was to compare the effectiveness of habit reversal with a placebo control as a treatment for chronic nail biting in adults.

Method: Thirty adults with a chronic nail-biting problem (occurring ≥ 5 times/day nearly every day for ≥ 4 weeks and causing physical damage or social impairment) were randomly assigned to a placebo control or habit reversal group. Five participants withdrew from the study prior to the completion of treatment. The remaining individuals in both groups received a total of 2 hours of treatment over 3 sessions. Individuals in the habit reversal group (N = 13) received the components of awareness training, competing response training, and social support. Individuals in the placebo control group (N = 12) simply discussed their nail biting. At pretreatment, posttreatment, and a 5-month follow-up, nail length was measured, photographs were taken of the damaged nails and later rated by independent observers, and data on participant depression, anxiety, and self-esteem were obtained. Treatment compliance and acceptability data were collected at posttreatment only.

Results: Results showed that habit reversal produced a greater increase in nail length at posttreatment and follow-up when compared with the placebo. Data from the independent raters confirmed these findings. Habit reversal was also viewed as a more acceptable intervention by the participants. At posttreatment, the habit reversal group had increased their nail length by 22% from pretreatment compared with a 3% increase for the placebo group. At follow-up, the habit reversal group maintained a 19% increase in nail length from pretreatment compared with a 0% increase for the placebo group.

Conclusion: Findings from this study suggest habit reversal is more effective than a placebo control and should be considered a well-established intervention for body-focused repetitive behaviors.

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A substantial number of adults engage in body-focused repetitive behaviors such as nail biting, skin picking, or chewing on one's own skin (e.g., lips, inner cheeks). For example, research shows that 63.6% of college students report a nail-biting habit[1] and 42% habitually chew on their mouth, lips, and cheeks.[2] For the majority of these individuals, the behavior is infrequent and does not cause physical injury or other impairment. However, recent research investigating the prevalence of injury- or impairment-causing repetitive behaviors in college students suggests that problematic body-focused repetitive behaviors are still relatively common, with 2.7% engaging in skin picking, 5.7% engaging in mouth, lip, or cheek chewing, and 6.4% engaging in nail biting.[3] Similar research in a German student population found that 4.6% picked their skin to the point of producing substantial impairment.[4]

The types of injury or impairment associated with body-focused repetitive behaviors range from physical to psychological. Physically, nail biting can lead to dental problems such as atypical root resorption,[5] periungual warts, hangnails,[6] chronic paronychia,[7] and gingival swelling.[8] Likewise, skin picking can produce minor sores, permanent scars, skin infections, and skin craters.[9] Psychologically, persons with body-focused repetitive behaviors have been found to be more anxious and depressed and experience greater levels of shame and guilt than individuals without such behaviors (reference 9 and E.J.T., D.W.W., M.P.T., unpublished manuscript, 2002). In addition, problematic body-focused repetitive behaviors may occur with a variety of comorbid psychiatric conditions, including major depression, generalized anxiety disorder, and body dysmorphic disorder.[10] Unfortunately, it is not clear if these psychological states contribute to or are the result of the body-focused repetitive behavior.

As evidence has mounted regarding the detrimental physical and psychological factors associated with body-focused repetitive behaviors,[11] researchers have focused on treating these behaviors using various interventions. For example, self-monitoring, reinforcement procedures, and punishment procedures such as response cost, covert sensitization, and applying a bitter substance to the finger have all been proved effective in treating nail biting.[12–15]

Another widely used technique has been habit reversal. Originally developed by Azrin and Nunn[16] as a multicomponent treatment for nervous habits and tics, researchers have found the essential features of the procedure to include awareness training, competing response training, and social support.[17] In awareness training, individuals are taught to define and identify the target behavior along with its antecedents. The individual then learns to engage in a physically incompatible (to the target) behavior for 1 to 3 minutes contingent on the target behavior or one of the previously identified antecedents. This procedure is known as competing response training. Finally, in the social support phase, a significant person in the individual's life is recruited to prompt the correct use of the competing response and praise the individual's correct implementation of the procedure.

Habit reversal has been found to be effective in treating a variety of body-focused repetitive behaviors, including skin picking,[18] oral-digital habits,[19–24] and chewing on one's own skin.[25] In addition, the procedure has been found effective in treating tic disorders,[17,26–28] trichotillomania,[29,30] stuttering,[31,32] and other "nervous habits."[28,33]

Despite this high level of attention and wide applicability, habit reversal has yet to be considered a well-established empirically validated treatment by the Task Force on Promotion and Dissemination of Psychological Procedures.[34] The Task Force, established by Division 12 of the American Psychological Association, was created to provide guidelines for determining if a psychological procedure has garnered enough support to be considered "empirically validated." Currently, there are 2 classifications including "probably efficacious" and the more stringent "well-established." Habit reversal is currently classified as "probably efficacious" and appears to have been prevented from being upgraded to a "well-established" status because of the Task Force requirement that the procedure be proved more effective than a psychological placebo or other intervention. Multiple examinations of the habit reversal literature have shown no comparisons of habit reversal with a psychological placebo, although many researchers have called for such investigations.[24,35]

The current study was conducted to offer additional support for the efficacy of habit reversal as a treatment for one type of body-focused repetitive behavior, nail biting. In addition, the current study was designed to address the limitations of previous habit reversal research and to meet criteria for a well-established intervention by comparing habit reversal with a placebo control. Finally, the present study determined the effects of habit reversal on 3 of the psychological correlates of body-focused repetitive behavior problems, anxiety, depression, and negative self-esteem.

Three hypotheses were tested in this study. First, it was hypothesized that habit reversal would be more effective than a placebo control in producing a socially valid increase in nail length. Second, it was hypothesized that habit reversal would be more effective than the placebo control in reducing levels of anxiety, depression, and negative self-esteem. Finally, it was hypothesized that habit reversal would be viewed as a more acceptable treatment than the placebo control.

METHOD

Participants

Because no specific DSM-IV[36] criteria exist for diagnosing nail biting, criteria used to identify problematic body-focused repetitive behaviors in previous research were employed.[3] To qualify for participation, individuals had to report biting their nails 5 or more times per day, nearly every day for at least 4 weeks. In addition, the participants had to report that the behavior caused physical damage or social impairment. Thirty individuals met these criteria and agreed to participate in the study. Twenty-three participants were female and 7 were male. The mean age of the group was 23 years (range, 18–49 years). The sample was 93% white (N = 28), 3.3% Hispanic (N = 1), and 3.3% African American (N = 1). The sample had a mean IQ of 110 (range, 95–124). During the course of the study, 5 participants dropped out between pretreatment and posttreatment, leaving 25 participants for subsequent pretreatment/posttreatment analyses. An additional 6 dropped out from posttreatment to follow-up, leaving 19 for follow-up analyses. Of the participants who completed the entire study (pretreatment, posttreatment, follow-up), 3 were men and 16 were women. The mean age of the group who completed the study was 21.5 years. To determine if the group of individuals who dropped out of the study differed from those who completed the study, a series of independent-samples t tests were conducted on age, IQ, and all pretreatment administrations of the dependent measures. Results showed that the groups did not differ across any of these measures (see Table 1 for descriptive statistics).

Materials

Nail-length measure. Nail length was measured in millimeters using a standard metric ruler. Graduate students, who were not blinded to treatment status, performed all measurements. The length of the nail on each finger was measured from the cuticle to the most distant point on the tip of the nail. Nails were measured once at pretreatment, posttreatment, and the 5-month follow-up. For each measurement period, a mean nail length was calculated across all 10 nails.

Nail photographs. Photographs of the participants' hands were taken once at pretreatment, posttreatment, and follow-up. All photographs were taken with a digital camera placed approximately 30 cm from the hands. Participants' identities and their status in the study could not be

Table 1. Pretreatment Measures Across Treatment Completers and Noncompleters

	Completed Entire Study (Pre, Post, Follow-Up) (N = 19)[a]		Dropped Out Prior to Posttreatment (N = 5)[b]		Dropped Out Between Posttreatment and Follow-Up (N = 6)[c]	
Measure	Mean	SD	Mean	SD	Mean	SD
IQ (WASI score)	110.5	8.8	108.2	9.6	111.7	8.2
BDI score	9.0	8.4	12.8	7.7	6.0	7.0
STAI-state score	38.4	9.8	47.0	13.2	33.3	8.6
STAI-trait score	45.1	13.1	54.0	16.5	38.2	9.3
GSE score	50.8	14.4	48.6	7.1	56.0	14.2
Nail length, mm	9.4	1.7	9.9	1.8	8.9	2.0

[a]Mean age = 21.5 years; range, 18–41 years.
[b]Mean age = 23.4 years; range, 18–39 years.
[c]Mean age = 27.5 years; range, 19–49 years.
Abbreviations: BDI = Beck Depression Inventory, GSE = global self-esteem factor on the Multidimensional Self-Esteem Inventory, STAI = State-Trait Anxiety Inventory, WASI = Wechsler Abbreviated Scale of Intelligence.

determined from the photograph. All photographs were downloaded to a computer.

Social Validity Scale. The Social Validity Scale (see Appendix 1) is a 3-item questionnaire, developed by the authors, that asks about (1) nail damage, (2) perceived problem for the person in the photo, and (3) need for treatment of nail biting. Each item was rated on a 7-point Likert-type scale with higher numbers reflecting greater social validity.

State-Trait Anxiety Inventory (STAI).[37] This 40-item self-report questionnaire was designed to assess an individual's anxiety. Twenty questions measure "state" anxiety and 20 questions measure "trait" anxiety. Participants were instructed to read each statement and indicate how true that statement was for them by responding on a scale ranging from 1 to 4. Higher scores represented a higher level of state or trait anxiety.

Normative data have shown that for college students (aged 18 to 24 years) the mean trait score for females is 40.40 (SD = 10.15) and for males is 38.30 (SD = 9.18). For the state scores, the mean score for females is 38.76 (SD = 11.95) and for males is 36.47 (SD = 10.02). Test-retest reliability for the trait scale is between 0.73 and 0.86, while test-retest reliability for the state scale is considerably lower, ranging from 0.16 to 0.54. The STAI scales have demonstrated good internal consistency (α = .90 to .93) as well as good construct validity.[37]

Beck Depression Inventory (BDI).[38] The BDI was designed to measure the presence and degree of depression. Participants were asked to place a mark next to the statement best describing how they felt over the past week for each of 21 items. Four possible choices, ranging in severity from a score of "0" indicating little distress to a score of "3" indicating much distress, were offered for each item. Scores were summed across all items with a higher overall score signifying higher levels of depression.

Normative data have shown that clinically depressed individuals typically score between 10 and 30, ranging from mild to severe depression.[39] The BDI has good test-retest reliability (r = 0.90), and estimates of internal consistency have ranged from .73 to .92. In addition, much cross-validation research strongly supports the validity of the BDI.[40]

Multidimensional Self-Esteem Inventory (MSEI).[41] The MSEI is a 116-item test used to evaluate self-esteem. Participants rated each item on a 5-point scale with lower scores indicating greater problems with self-esteem. The MSEI yielded a general factor called global self-esteem. The global self-esteem factor is reported in the form of a T score, with a T score below 30 being indicative of a significantly high negative evaluation of self. The global self-esteem factor has been found to be internally consistent and stable.[41] Likewise, the MSEI has demonstrated acceptable validity.[41]

Modified Treatment Evaluation Inventory-Short Form (MTEI-SF). The MTEI-SF is a 7-item treatment evaluation inventory modified from the Treatment Evaluation Inventory-Short Form (TEI-SF)[42] that assessed participants' opinion of the treatment. The inventory asked (1) if the participant found the treatment to be an acceptable way of dealing with nail biting, (2) if the participant liked the procedures used in the treatment, (3) if the treatment was likely to be effective, (4) if the participant experienced discomfort as a result of the treatment, (5) if the participant believed this treatment would result in permanent improvement, (6) if it would be acceptable to use this treatment with individuals who cannot choose treatment for themselves, and (7) if, overall, the participant had a positive reaction to this treatment. Each question was rated on a 5-point Likert-type scale with higher numbers reflecting greater acceptability. The values were summed and resulted in a treatment acceptability score for each participant. Because 20 was the midpoint on the scale, scores over 20 were deemed to indicate greater acceptability than unacceptability of the intervention.

Treatment Compliance Questionnaire (TCQ). This 4-item questionnaire was created by the authors to provide descriptive data on participant compliance with the treatment procedures. The individual items of the TCQ can be found in Table 2. Participants in the habit reversal group completed the TCQ at posttreatment.

Wechsler Abbreviated Scale of Intelligence (WASI).[43] The WASI was a norm-referenced abbreviated intelligence test designed to provide IQ estimates for individuals aged 6 to 83 years. The WASI produced a full scale IQ score with a mean of 100 and a standard deviation of 15. To obtain the estimated IQ score, a 2- or 4-subtest version could have been administered. The 2-subtest version was administered in this study. The 2-subtest version demonstrated a split-half reliability of r = 0.93 and a temporal

Table 2. Percentage of Participants in the Habit Reversal Group (N = 13) Who Answered Treatment Compliance Questionnaire Questions With Varying Degrees of Compliance[a]

Question	Percentage of Time				
	100%	75%–99%	50%–74%	25%–49%	0%–24%
1. Approximately how often did you actually do your competing exercises when you did the warning signs?	7.7	61.5	23.1	7.7	0
2. Approximately how often did you actually do your competing exercises when you did the nail biting?	38.5	53.8	0	7.7	0
3. How often did the support person remind you to do your exercises when he or she saw you bite your nails or do a warning sign, but not actually do your exercises?	15.4	30.8	30.8	7.7	15.4
4. How often did the support person acknowledge that you had done your exercises correctly. In other words, how often did the support person praise you for doing the treatment right?	7.7	23.1	38.5	15.4	15.4

[a]The Treatment Compliance Questionnaire is available from the authors upon request.

Table 3. Pretreatment Measures Across Habit Reversal and Placebo Control Groups

Measure	Habit Reversal (N = 13)[a]		Placebo Control (N = 12)[b]	
	Mean	SD	Mean	SD
IQ (WASI score)	109.8	7.9	113.2	6.1
BDI score	8.4	9.4	9.6	8.3
STAI-state score	37.9	10.8	35.8	8.7
STAI-trait score	44.6	12.7	41.5	12.4
GSE score	51.5	14.5	52.6	14.5
Nail length, mm	10.2	1.3	8.2	1.3

[a]Mean age = 23.3 years; range, 18–41 years.
[b]Mean age = 24.3 years; range, 19–49 years.
Abbreviations: BDI = Beck Depression Inventory, GSE = global self-esteem factor on the Multidimensional Self-Esteem Inventory, STAI = State-Trait Anxiety Inventory, WASI = Wechsler Abbreviated Scale of Intelligence.

stability of r = 0.85. The WASI has demonstrated acceptable content, concurrent, and construct validity.

Procedures

After giving informed consent, participants were randomly assigned to 1 of 2 groups. Participants in the first group received the habit reversal protocol outlined in a treatment manual by Woods and Twohig.[44] Participants in the second group received a placebo intervention. The pretreatment data collected on both groups are presented in Table 3 for descriptive purposes.

In both groups, the number of sessions and duration of therapy were the same and therapy was conducted by 2 graduate students in psychology. The therapists were trained and supervised by the second author. After an initial pretreatment meeting in which nail length was measured, pretreatment photographs were taken, and the WASI, BDI, STAI, and MSEI were completed, a 1-hour therapy session was held. After the first 1-hour session, participants in both groups had 2 additional 30-minute sessions in the 2 weeks subsequent to the first 1-hour therapy session (one 30-minute session per week).

One week after the final treatment session, participants in both groups again completed a measure of nail length, had photographs taken of their nails, and completed the BDI, STAI, MSEI, MTEI-SF, and TCQ (the control group did not complete the TCQ). These same data (with the exception of the MTEI-SF and TCQ) were collected again at a 5-month follow-up.

Habit reversal group. Participants in the habit reversal group received the entire procedure during the first 1-hour session, with the two 30-minute sessions serving as "booster" sessions. During this initial session, those in the habit reversal group first learned to be "aware" of their habit. This was done by having the participant work with the clinician to provide a very detailed operational definition of the nail biting and its antecedents. After the clinician felt the description was accurate, the participant was asked to detect therapist-simulated occurrences of the behavior or its antecedents until he or she did so with 80% accuracy. Next, the participant was asked to acknowledge his or her own in-session occurrence of nail biting (or simulated nail biting if none was actually occurring) and its antecedents until he or she was 80% correct.

After awareness had been successfully achieved, a competing response was introduced. Specifically, participants learned to engage in mild fist clenching for 1 minute contingent on the nail biting or its antecedent(s). This was demonstrated by the clinician and practiced by the participant until he or she was correctly implementing the competing response contingent on 80% of the nail biting and antecedent occurrences.

To complete the first session, the participant was asked to identify a support person who could (1) prompt the participant to use the competing response when it was not being used correctly and (2) praise the participant when the competing response had been implemented in the proper fashion. After identifying a support person, the participant practiced (with the therapist) the way to ask the support person for assistance. The participant was then asked to recruit help from the support person before the next session.

During the second and third treatment sessions, the participants in the habit reversal group reviewed, with the therapist, the 3 components of the procedure. Participants were asked to explain the proper use of habit reversal. Incorrect answers resulted in the therapist and client re-

Table 4. Sample Questions Used in the Placebo Treatment Group of Chronic Nail Biters

Do you have any other habits such as skin picking?
How long have you been biting your nails?
Do you remember the first time you bit your nails?
Which nails do you bite and on what hands?
Does anyone in your family bite their nails?
Were there any times in your life when you didn't bite your nails?
What are situations where you do not bite your nails?
What was going on in your life when you began biting your nails?
Did you paint your nails when you were younger?
What other methods did you try to stop biting your nails?
Why do you want to stop biting your nails?
What emotions do you feel cause your nail biting?
How does nail biting interfere with your life?
Why do you think you bite your nails?

implementing that component of the procedure from the first session. At the end of the second 30-minute session, treatment was completed.

Placebo control group. At the start of the 1-hour session, participants in the placebo control group were provided with a rationale for treatment. They were told the following:

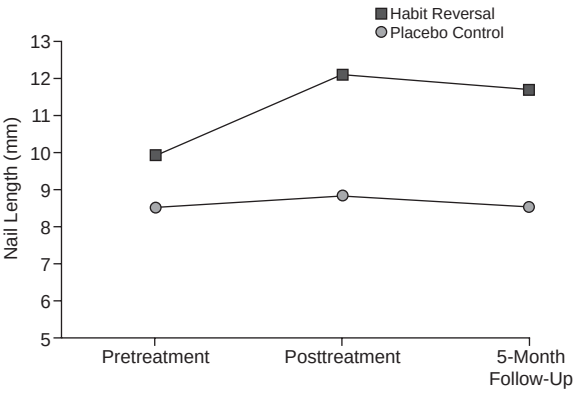
> The treatment involves discussing your nail-biting habit in the hope of uncovering important unconscious psychological features to your habit. I have prepared a list of questions pertaining to your nail biting that I would like to discuss with you. It is believed that by discussing the habit, other information that you have forgotten will be remembered. The assumption is that if you can bring the nail-biting–related events to consciousness, this alone will be effective in decreasing your nail biting. The questions are on such topics as when the nail biting started, how long you have been doing it, and in what situations it is most likely to occur. If you are ready, we can go over the questions.

Questions were then asked, and the therapist and participant discussed the participant's nail biting for the remainder of the 1-hour session. A list of the questions asked can be found in Table 4. At the end of session 1, participants were asked to keep a journal of their feelings about nail biting. They were asked to write at least 1 or 2 sentences each night about their feelings toward the habit or anything new they learned about the biting.

In the subsequent 30-minute sessions, the participant and researcher reviewed the journal entries and discussed any new information the participant remembered about the habit in the past week. If time remained, additional questions from the list provided earlier were discussed. At the end of the second 30-minute session, the placebo treatment was completed.

Social validity. To determine if the changes in nail length were socially valid, the pretreatment, posttreatment, and follow-up photographs were randomly ordered and shown to 10 graduate psychology students who were blinded to the treatment group membership and to the phase in the study from which each photograph was obtained. After viewing each photograph for 10 seconds, participants were asked to complete the Social Validity Scale (see Appendix 1). Scores on the Social Validity Scale were then averaged across both hands for each participant so that each participant had mean pretreatment, posttreatment, and follow-up scores.

Figure 1. Mean Nail Length (in mm) Across All Fingers for the Habit Reversal (N = 13) and Placebo (N = 12) Groups at Pretreatment, Posttreatment, and Follow-Up



RESULTS

Nail Length

Separate univariate analyses of covariance (ANCOVAs) were conducted to compare the 2 groups (habit reversal and placebo control) at posttreatment and again at follow-up. The pretreatment nail length was used as a covariate in both analyses because pretreatment nail length differed between the groups despite randomization. Separate analyses were conducted so the data for those participants who dropped out between posttreatment and follow-up would still be analyzed from pretreatment to posttreatment.

At posttreatment, the nail length of the 2 groups differed significantly ($F = 21.2$, $df = 1,22$; $p < .01$, $\eta^2 = .49$), with the habit reversal group (adjusted mean [M_{adj}] ± SD = 12.1 ± 1.9 mm) exhibiting significantly longer nails than the placebo control group (M_{adj} ± SD = 8.8 ± 1.6 mm). These results were maintained at follow-up ($F = 7.8$, $df = 1,17$; $p < .05$, $\eta^2 = .31$), with the habit reversal group exhibiting significantly longer nails (M_{adj} ± SD = 11.72 ± 2.5 mm) than the placebo control group (M_{adj} ± SD = 8.5 ± 1.7 mm). These data are presented in Figure 1.

Social Validity Ratings

Each of the 3 questions on the Social Validity Scale was evaluated using a series of univariate ANCOVAs. A

Table 5. Means ± SD for the 3 Social Validity Questions at Pretreatment, Posttreatment, and Follow-Up Across All Raters[a]

	Habit Reversal						Placebo Control					
	Pretreatment		Posttreatment		Follow-Up		Pretreatment		Posttreatment		Follow-Up	
Question	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
How damaged are the person's fingernails?	3.88	1.70	5.95	1.37	5.40	1.81	2.35	1.26	3.00	2.00	2.32	1.40
How much of a problem is nail biting?	3.94	1.75	6.06	1.29	5.36	1.91	2.27	1.33	3.03	2.12	2.40	1.46
Need of treatment for nail biting?	3.92	1.85	6.07	1.47	5.43	1.92	2.20	1.30	2.95	2.17	2.27	1.54

[a]Scores range from 1 to 7 with lower scores representing more impairment.

separate univariate (i.e., group) ANCOVA was conducted for each social validity question at posttreatment and follow-up. In each analysis, the score to the pretreatment administration of the question being targeted for analysis was used as the covariate. Separate ANCOVAs were used because (1) a preliminary analysis of the data showed that the 2 groups (habit reversal and placebo) differed in severity ratings at pretreatment for all 3 questions despite randomization, with the placebo control group being rated as more severe and (2) because 6 participants dropped out between posttreatment and follow-up. To maximize power for the posttreatment analysis, the separate ANCOVAs were conducted. Results are presented in Table 5.

At posttreatment, analyses of all 3 questions yielded similar results. There were significant group (habit reversal vs. placebo) differences (question 1: $F = 83.9$, $df = 1,247$; $p < .01$, $\eta^2 = .25$; question 2: $F = 87.1$, $df = 1,247$; $p < .01$, $\eta^2 = .26$; question 3: $F = 85.6$, $df = 1,247$; $p < .01$, $\eta^2 = .26$). Results were the same for the 3 questions in the analyses of the follow-up data (question 1: $F = 76.3$, $df = 1,167$; $p < .01$, $\eta^2 = .31$; question 2: $F = 52.5$, $df = 1,157$; $p < .01$, $\eta^2 = .25$; question 3: $F = 61.9$, $df = 1,157$; $p < .01$, $\eta^2 = .28$). These results suggest that the improvement to the nails of those in the habit reversal group was significantly more noticeable to independent observers than those improvements demonstrated by participants in the placebo control group. These differences were maintained at posttreatment and follow-up.

Measures of Psychological Functioning

To determine if habit reversal had an effect on the measures of psychological constructs typically associated with body-focused repetitive behavior problems, separate 2 (group) × 2 (pretreatment to posttreatment or pretreatment to follow-up) mixed analyses of variance (ANOVAs) were conducted to compare the 2 groups at posttreatment and again at follow-up for each measure of psychological functioning (BDI, STAI-state, STAI-trait, and the global self-esteem factor of the MSEI). Separate ANOVAs were conducted for each measure so the data for those participants who dropped out between posttreatment and follow-up would still be analyzed from pretreatment to posttreatment. Initial independent-samples t tests on the pretreatment administrations of these measures demonstrated that randomization was effective, as there were no significant differences between the 2 groups on the pretreatment measures.

Analysis of the BDI data showed a significant decrease in reported depression scores from pretreatment (mean ± SD = 8.3 ± 8.0) to posttreatment (5.6 ± 4.7) ($F = 4.4$, $df = 1,23$; $p < .05$, $\eta^2 = .16$). In the analysis of only those participants who completed follow-up, results also showed a significant decrease in depression scores from pretreatment (9.37 ± 8.1) to follow-up (4.8 ± 6.5) ($F = 6.8$, $df = 1,17$; $p < .05$, $\eta^2 = .29$). However, there were no significant effects of treatment (habit reversal vs. placebo), nor were the treatment by assessment period (pretreatment, posttreatment, follow-up) interactions significant. Combined, these results suggest that although self-reported depression decreased over the course of treatment, this effect was not due to the effects of habit reversal.

In the analyses of the STAI state data, results showed no significant main effects of time (pretreatment to posttreatment and pretreatment to follow-up) or group. The group by time interaction was also nonsignificant. These results suggest that habit reversal had no impact on levels of state anxiety.

Analysis of the STAI trait data shows a significant decrease in reported anxiety scores from pretreatment (43.1 ± 12.3) to posttreatment (38.8 ± 8.9) ($F = 4.9$, $df = 1,18$; $p < .05$, $\eta^2 = .21$). In the analysis of only those participants who completed follow-up, results also showed a significant decrease in trait anxiety scores from pretreatment (45.3 ± 13.2) to follow-up (37.7 ± 10.5) ($F = 8.4$, $df = 1,13$; $p < .05$, $\eta^2 = .39$). There were no significant effects of treatment, nor were the treatment by assessment period (pretreatment, posttreatment, follow-up) interactions significant. Combined, these results suggest that although trait anxiety decreased over the course of treatment, this change was not due to the effects of habit reversal.

Analyses of the global self-esteem data from the MSEI showed no significant main effects of time (pretreatment to posttreatment and pretreatment to follow-up) or group. The group by time interaction was also nonsignificant. These results suggest that habit reversal had no effect on self-esteem.

In summary, these results suggest that habit reversal did not significantly affect the psychological constructs

typically associated with nail biting and other body-focused repetitive behaviors.

Treatment Acceptability

The treatment acceptability data (MTEI-SF scores) were analyzed with an independent-samples t test. Results showed that treatment was more acceptable to the habit reversal group (30.46 ± 2.9) than it was to participants in the placebo group (23.6 ± 4.7) ($t = 4.0$, $df = 23$, $p < .01$, $\eta^2 = .46$). However, results indicated that both groups found their treatment to be more acceptable than unacceptable.

Treatment Compliance Questionnaire

As can be seen in Table 2, participants in the habit reversal group reported being compliant with the treatment procedures, although their compliance was not complete. In an attempt to determine whether self-reported treatment compliance predicted nail regrowth, separate correlations were calculated between the 4 TCQ questions and the percentage of nail regrowth at posttreatment and follow-up. Levels of compliance (e.g., 100% of the time, 75%–99% of the time; see Table 2) were assigned numbers 1 to 5, with lower numbers reflecting greater compliance. These assigned numbers were then correlated with a percentage of nail regrowth, which was calculated by subtracting baseline nail length from posttreatment (and follow-up) nail length. The difference was then divided by the baseline nail length and multiplied by 100%.

Although none of the correlations were statistically significant, the highest correlations were between doing the competing response contingent on the nail biting (question 2 on the TCQ) and nail regrowth ($r_s = –0.40$) and obtaining appropriate praise from the social support person (question 4 on TCQ) and nail regrowth ($r_s = –0.47$). In both cases, because of the wording on the TCQ, a negative correlation would suggest that as the person became more compliant, greater nail regrowth was found. Interestingly, in examining the correlations between treatment compliance at posttreatment and nail regrowth at follow-up, the highest correlation was between regrowth and engaging in the competing response contingent on the antecedents ($r_s = –0.28$; question 1 on TCQ), whereas engaging in the competing response contingent on the nail biting was much more weakly correlated with regrowth ($r_s = –0.12$).

DISCUSSION

The present study tested 3 hypotheses. First, it was hypothesized that habit reversal would be more effective than a placebo control in producing a socially valid increase in nail length in persons who chronically bit their nails. Results found support for this hypothesis. Individuals who received a 3-session habit reversal treatment increased their nail length an average of 22% (from baseline) at posttreatment and 19% (from baseline) at follow-up, compared with the placebo control participants who exhibited a 3% (from baseline) increase in nail length at posttreatment and a 0% (from baseline) increase at follow-up. These results were confirmed by independent raters who viewed pretreatment, posttreatment, and follow-up photographs of the participants' nails and found that habit reversal produced more improvement than the placebo group at posttreatment and follow-up. For those in the habit reversal group, an attempt was made to predict outcome from measures of treatment compliance. Unfortunately, the compliance measures did not correlate significantly with outcome, potentially due to low statistical power. Despite this lack of statistical significance, compliance with certain treatment components (i.e., competing response done contingent on the biting and social support praise) was more highly correlated with outcome than others. Such results suggest further research is necessary in predicting the efficacy of habit reversal from information on treatment compliance.

The second hypothesis tested in this study was that habit reversal would be more effective than the placebo control in decreasing the intensity of the psychological states commonly occurring in persons with body-focused repetitive behaviors. However, results of the current study did not support this hypothesis. Habit reversal appeared to be no more effective than the placebo control in altering psychological states commonly co-occurring with body-focused repetitive behaviors. There is at least one plausible explanation for this finding. Specifically, it is likely that the present sample presented with relatively "normal" levels of anxiety, depression, and self-esteem. When comparing the pretreatment levels of our sample with published normative data on the instruments, this conclusion seems to be supported. As a result, perhaps a floor effect was encountered such that the participants could not have changed significantly even if the intervention was effective in producing such a change. A second possibility is that small sample sizes in the present study led to low power, which precluded the detection of a significant effect.

Regardless of the reason(s) why habit reversal failed to produce a significant change in the psychological construct measures, it is interesting to note that habit reversal was still effective in increasing nail length. This may suggest that it is unnecessary to address variables such as anxiety, depression, and low self-esteem when treating a body-focused repetitive behavior such as nail biting. Although some researchers make reference to and imply the causal status of psychological constructs such as anxiety or depression (reference 9 and E.J.T., D.W.W., M.P.T., unpublished manuscript, 2002) when explaining the genesis or maintenance of body-focused repetitive behaviors, little experimental research has been conducted to test these claims.

One possible way to understand this discrepancy comes from recent research[10] that makes the distinction between focused and nonfocused repetitive behaviors. *Focused* repetitive behaviors refer to behaviors that have an emotional control component (e.g., intentional biting in response to a specific anxiety producing situation), while *nonfocused* repetitive behaviors are those that are more habitual (e.g., out of one's ongoing awareness). It is thought that both types can occur in the same individual. Thus, habit reversal may be effective in eliminating the nonfocused behavior, while elimination of the less frequent focused biting would require additional intervention, such as cognitive therapy.[9,45]

The final hypothesis tested in this study was that habit reversal would be viewed as a more acceptable treatment than the placebo control. Results supported this hypothesis. Findings showed that participants in both groups found their treatment to be more acceptable than unacceptable, but that habit reversal was found to be significantly more acceptable than the placebo control. In addition to supporting the third hypothesis, these findings lend support to the idea that participants in the placebo control group believed their treatment was an acceptable intervention despite the fact that it had no apparent impact on their behavior.

The present study makes a number of contributions to the extant research on body-focused repetitive behaviors and habit reversal. First, this is the first study to demonstrate the effectiveness of habit reversal in a randomized, single-blind, placebo-controlled study using a specific treatment manual. This type of study is necessary for habit reversal to be considered a "well-established" intervention by the Division 12 Task Force of the American Psychological Association. Second, this study was one of the first studies to examine the effects of habit reversal on the psychological conditions that commonly coexist with body-focused repetitive behaviors such as nail biting or skin picking. Third, the present study showed that a brief intervention (i.e., 2 hours of total treatment time) could produce a 22% posttreatment increase in nail length that decreased little at a 5-month follow-up.

These strengths aside, the current study also suggests a number of areas for future research. First, although the participants actually had problems with nail biting, the sample primarily included college students. As a result, those in our sample may differ from those in the broader community who engage in similar behaviors. Thus, the present study should be replicated with a more diverse sample. Second, the power in this study was relatively low for detecting change in the psychological measures as well as for detecting potential predictors of treatment outcome. Future research should be conducted with larger samples to answer questions more thoroughly. Third, it seems imperative to continue to evaluate the causal theories of body-focused repetitive behaviors such as nail biting and skin picking. To date, research on these behavior problems has tended to be correlational or descriptive in nature, with very little attention given to research utilizing experimental designs. The development of such research could potentially lead to new interventions or enhancements to currently successful procedures such as habit reversal.

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Appendix 1: Social Validity Scale

1. In your opinion, how damaged are the person's fingernails?	very damaged						not at all damaged
	1	2	3	4	5	6	7
2. In your opinion, how much of a problem is nail biting for this person?	very much a problem						not at all a problem
	1	2	3	4	5	6	7
3. In your opinion, is this person in need of treatment for nail biting?	very needed						not at all needed
	1	2	3	4	5	6	7