Behavior Modification
http://bmo.sagepub.com/

Functional Analysis and Treatment of Nail Biting

Brad A. Dufrene, T. Steuart Watson and Jennifer S. Kazmerski

Behav Modif 2008 32: 913 originally published online 3 June 2008
DOI: 10.1177/0145445508319484

The online version of this article can be found at:
http://bmo.sagepub.com/content/32/6/913

Published by:
SAGE
http://www.sagepublications.com

Additional services and information for *Behavior Modification* can be found at:

Email Alerts: http://bmo.sagepub.com/cgi/alerts

Subscriptions: http://bmo.sagepub.com/subscriptions

Reprints: http://www.sagepub.com/journalsReprints.nav

Permissions: http://www.sagepub.com/journalsPermissions.nav

Citations: http://bmo.sagepub.com/content/32/6/913.refs.html

>> Version of Record - Oct 23, 2008

OnlineFirst Version of Record - Jun 3, 2008

What is This?

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Behavior Modification
Volume 32 Number 6
November 2008 913-927
© 2008 Sage Publications
10.1177/0145445508319484
http://bmo.sagepub.com
hosted at
http://online.sagepub.com

Functional Analysis and Treatment of Nail Biting

Brad A. Dufrene
The University of Southern Mississippi
T. Steuart Watson
Miami University
Jennifer S. Kazmerski
Mississippi State University

This study applied functional analysis methodology to nail biting exhibited by a 24-year-old female graduate student. Results from the brief functional analysis indicated variability in nail biting across assessment conditions. Functional analysis data were then used to guide treatment development and implementation. Treatment included a simplified habit reversal package that was modified based on results of the functional analysis. Following treatment implementation, nail biting decreased as evidenced by consistent nail growth and participant self-recorded data. Results are discussed in terms of treatment utility of functional analysis methodology for novel populations and response topographies.

Keywords: *functional analysis; nail biting; habits; applied behavior analysis; simplified habit reversal*

Nail biting may emerge in early childhood and, in some cases, continue into adulthood. Prevalence for nail biting increases during childhood, peaks at approximately 45% during adolescence, then decreases during adulthood to approximately 4.5% with females engaging in nail biting more than males (Peterson, Campose, & Azrin, 1994). Chronic habits such as nail biting, trichotillomania, bruxism, and thumb sucking may result in a variety of negative social and medical consequences. Nail biting in particular may result in damage to tissue around the nail, infection, and root damage to the individual's teeth (Silber & Haynes, 1992).

Theory and research describing etiology of nail biting offers varying and sometimes conflicting explanations. Early theorists suggested that nail

Authors' Note: Please address correspondence to Brad A. Dufrene, 118 College Drive #5025, Hattiesburg, MS 39406; phone/fax: 601-266-5256; e-mail: brad.dufrene@usm.edu.

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

biting in children might be reflective of underlying psychopathology. However, Friman, Larzelere, and Finney (1994) found that children presenting with habit behaviors, including nail biting, did not significantly differ in terms of deviant behavior from their peers who did not present with habits. Others have suggested an association between nail biting and other habits and anxiety, finding positive correlations between nail biting and the Taylor Manifest Anxiety Scale (Klatte & Deardorff, 1981). Others, however, have failed to replicate the link between anxiety and habits (Deardorff, Finch, & Royall, 1974; Woods, Miltenberger, & Flach, 1996).

The environmental restriction theory suggests that limited motor activity may trigger nail biting (Hadley, 1984). This theory implies that limited motor behavior may result in an increase in habits such as nail biting. From a behavior analytic perspective, one may argue that environmental restriction serves as an establishing operation for the automatic reinforcement provided by habits such as nail biting (Michael, 1993). An additional explanation combines theories of anxiety and activity level and suggests that nail biting can be calming in anxiety arousing situations, as well as provide arousal induction in situations of limited activity. This is referred to as the arousal modulation theory (Hansen, Tishelman, Hawkings, & Doepke, 1990).

A variety of other theories is available to explain nail biting, many of which imply that characteristics intrinsic to the individual account for nail biting. As a result, traditional approaches to assessment of habits such as nail biting have focused solely on the topography of the behavior. Unfortunately, research supporting unique individual psychological characteristics as predictive of nail biting is mixed. Additionally, because the environmental restriction hypothesis states that nail biting may occur as a result of environmental conditions, research evaluating the extent to which individual and environmental variables in isolation or in combination result in an increased probability for nail biting is warranted.

From a behavioral perspective, habits are learned operants maintained by positive, negative, or automatic reinforcement (Watson & Dufrene, 2004). As such, functional and structural analysis methodologies provide a promising approach for not only identifying environmental determinants for a habit but the data may also be used to inform treatment planning. In fact, an emerging body of literature suggests that functional assessment and analysis methodologies may be used to identify structural and functional variables associated with habit responses. Additionally, structural and functional data may be used to guide treatment development and implementation (e.g., Watson, Dufrene, Weaver, Butler, & Meeks, 2005; Woods et al., 2001).

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Historically, functional analysis procedures have been used to identify the function of the self-injurious and stereotypic behaviors of individuals with developmental disabilities (Gresham et al., 2004). Woods and Miltenberger (1996) used modified functional analysis procedures to evaluate the role of anxiety in the exhibition of "nervous habits" such as hair, face, and object manipulation; object mouthing; and repetitive movements of the limbs. Participants (i.e., undergraduates) were exposed to an anxiety condition in which an experimenter presented the participant with an article and stated that they should prepare to give a 10-minute presentation. Additionally, a bored condition was conducted to test the theory of environmental restriction. Participants were asked to sit and do nothing for 10 minutes. Results indicated that hair and face manipulation occurred most during the anxiety condition and object manipulation occurred most often during the bored condition. However, habits that included mouthing did not occur at significantly different levels across conditions. These results suggest "nervous habits" may serve multiple functions. Additionally, the authors suggested that identifying conditions in which the behavior is most likely to occur allows a clinician to develop a strong hypothesis regarding the function of the habit behavior, has implications for treatment planning, and may reduce the need to pathologize habit behaviors (Woods & Miltenberger, 1996). However, this study did not include treatment data, so the authors could only speculate the extent to which functional analysis data were useful for treatment planning.

In a follow-up study, Woods and Miltenberger (2001) used further modified functional analysis procedures to evaluate nail biting by six typically developing children. Participants were exposed to several experimental conditions using a brief multielement design that tested various theories for nail biting. Experimental conditions included multiple alone (i.e., TV, idle, and game), social (i.e., noncontingent attention, contingent attention, and discuss habit), and anxiety (i.e., demand) conditions. Alone conditions were used to test the environmental restriction hypothesis, social conditions were used to test the role of attention in nail biting, and the demand condition tested an anxiety hypothesis. Results indicated that, for one child, nail biting occurred most during the alone conditions. However, for the five remaining participants, multiple experimental conditions were associated with increases in nail biting with at least one alone condition being elevated for all participants. Moreover, no individual exhibited elevated nail biting in anxiety conditions alone. As a result, the anxiety theory for nail biting was not supported.

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Following brief functional analyses of nail biting, simplified habit reversal (SHR) was used to treat nail biting for four of the six participants. Reported results indicated substantial reductions in nail biting for those children. Unfortunately, important procedural information regarding the manner in which brief functional analysis data were directly linked to treatment development was not provided. As a result, conclusions regarding the treatment utility of functional analysis for nail biting could not be made.

In a study by Williams, Rose, and Chisholm (2007), brief functional analysis was used to evaluate experimental conditions similar to those tested by Woods and colleagues (2001). Forty undergraduate students who reported engaging in nail biting were exposed to alone, noncontingent social attention, demand, and reprimand conditions that tested environmental restriction, attention, and anxiety theories, respectively. Results indicated that undergraduate students engaged in many more acts of nail biting during the alone condition that, like the results from Woods and colleagues, supported the environmental restriction hypothesis for nail biting. Finally, similar to Woods and Miltenberger (1996), treatment data were not included and, as a result, usefulness of functional analysis data for treatment planning could not be evaluated.

Functional analysis of habits, and nail biting in particular, is emerging as a vibrant line of research. Preliminary results suggest that the environmental restriction hypothesis may be a viable explanation for nail biting for many individuals. However, research has indicated that environmental determinants of nail biting may vary across individuals. As a result, functional analysis of nail biting appears to be an attractive method for assessing the idiographic nature of nail biting. Researchers have suggested that functional analysis of nail biting may be useful in terms of gaining a better understanding of the etiology of nail biting as well as for using assessment data to identify treatments that have an a priori likelihood of success. Unfortunately, there is not substantial evidence supporting the treatment utility of functional analysis of nail biting. As a result, the present study was designed to (a) continue to extend the functional analysis literature by including typically developing individuals and novel response topographies, (b) replicate previous research by conducting a brief functional analysis of nail biting, (c) extend the literature by including evaluation of a treatment that was designed based on analysis data, and (d) evaluate the stability of brief functional analysis data over time by replicating a brief functional analysis of nail biting.

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Method

Participant and Setting

Mandy was a 24-year-old graduate student at a public university in the southeastern United States. She had self-referred to a university-based counseling center for treatment for nail biting. Mandy reported that she had been biting her nails since early adolescence. She indicated that she had never sought professional treatment for nail biting but that she had previously tried various self-implemented strategies (e.g., applying nail lacquer), but none was successful.

Mandy did not report a significant history of anxiety or depression. Additionally, for diagnostic screening, Mandy completed the State Trait Anxiety Inventory (STAI; STAI Forms Y-1 and Y-2; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). Results from the STAI and BDI-II did not indicate clinically significant concerns regarding anxiety or depression.

Therapy sessions and functional analysis procedures were conducted in a 3 × 3 m individual treatment room at the university-based counseling center. The room was equipped with a video camera that was linked to a video control room within the counseling center. Mandy sat facing the camera during all functional analysis and treatment sessions.

Dependent Measures

Nail biting, defined as any digit crossing the plane of the participant's lips (i.e., entering the mouth), was the dependent measure during the functional analysis sessions. Nail biting was recorded using a partial interval recording method and was coded using videotapes from each session. Nail length was the primary measure of treatment effectiveness and was measured in centimeters using a ruler. An adjunct measure of treatment effectiveness was client-recorded frequency count of nail biting within 1-hour intervals throughout the day outside of the clinic setting. Self-recorded data were collected during a period of 4 weeks (i.e., 2 weeks before treatment and 2 weeks following training for modified SHR). Additionally, after SHR was introduced, Mandy also self-recorded the frequency for instances in which she "caught" herself just before nail biting (i.e., competing response).

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Brief Functional Analysis

Brief functional analysis of nail biting included a brief multielement design with order of experimental conditions randomized. The design and experimental conditions were based on previous research that included functional analyses of nail biting (Woods et al., 2001). Experimental conditions in the brief functional analysis included noncontingent attention (conversation unrelated to nail biting), contingent attention (i.e., experimenter commented on nail biting), nail biting–related conversation, alone, alone while watching TV, alone while completing rating scales, demand with escape, and demand without escape. All conditions lasted 5 minutes, and an entire brief functional analysis was conducted in one clinic session. Two weeks after the first brief functional analysis, another brief analysis was conducted in an effort to evaluate the stability of brief functional analysis data over time. The second brief functional analysis was conducted in an identical manner as the first analysis except for one small procedural variation that is described below (i.e., alone with rating scales condition).

Three attention conditions were tested during the brief functional analysis to evaluate the effect of various forms of attention on nail biting. During the noncontingent attention condition, the therapist sat in the room with Mandy and engaged in conversation unrelated to nail biting (e.g., "small talk"). The noncontingent attention condition served as a control for the other attention conditions. The contingent attention condition included conversation between the therapist and Mandy, but if Mandy engaged in nail biting, the therapist acknowledged the occurrence of nail biting with a comment (e.g., "You must be anxious because I see you are biting your nails"). During the nail biting–related conversation, the therapist directed conversation in a semistructured interview format that included questions similar to those that would be asked during awareness training for SHR (Woods & Miltenberger, 2001).

Three alone conditions were conducted to test for automatic reinforcement during varying degrees of environmental restriction (Woods et al., 2001). During the alone (no stimulation) condition, Mandy sat alone in the therapy room with no stimuli or activity available for interaction. During the alone with TV condition, Mandy watched a movie (i.e., Bronx Tale; De Niro, Rosenthal, & Kilik, 1993). During the alone with rating scales condition, Mandy completed rating scales routinely completed during clinical evaluation. For the initial brief functional analysis, Mandy completed the STAI and during the second brief functional analysis, she completed the BDI-II.

Finally, two demand conditions were implemented to test for automatic negative reinforcement in the form of anxiety or tension reduction. Previously, researchers have hypothesized that nail biting may be evoked

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

by anxiety or tension and as a result, the act of nail biting may reduce or eliminate anxiety or tension (Deardorff et al., 1974; Klatte & Deardorff, 1981). During the demand without escape condition, Mandy completed items from a homework assignment from her graduate statistics course to test for automatic negative reinforcement (i.e., tension or anxiety reduction). The therapist was present while Mandy completed the statistics items, and if Mandy bit her nails, no consequence was provided and she continued to work on the statistics assignment. Previous research has indicated that completing mathematics problems may increase autonomic arousal (Abel, Larkin, & Edens, 1995) and statistics problems were chosen because of the ecological relevance for the client. The demand condition with escape included a 30-seconds break from completing statistics items contingent on nail biting and tested for socially mediated negative reinforcement. Thus, if Mandy engaged in nail biting during the demand with escape condition, the therapist said "It looks like you are anxious, take a brief break." Following the 30-seconds escape period, the therapist prompted Mandy to resume the statistics assignment.

Intervention Implementation and Evaluation

Intervention was developed based on results from diagnostic screening (i.e., STAI and BDI-II) and the brief functional analysis. Intervention included a modified SHR package; specifically, Mandy was taught an SHR procedure that included awareness training, competing response, and social support. Training for SHR began during the treatment session following the second brief functional analysis. Awareness training was completed in one session, and competing response training and discussion of social support were conducted during the next therapy session. Training for SHR was based on conventional procedures described in the literature (see Woods & Miltenberger, 2001, for detailed description). Effects of intervention were evaluated using a nonexperimental A-B design with follow-up with total nail length as the dependent measure. Baseline total nail length was measured at the beginning of the treatment session during which SHR was introduced. Subsequently, nail length was measured at the beginning of each treatment session. Once intervention was introduced, treatment sessions occurred across successive weeks on the same day at 2 p.m.

Interobserver Agreement (IOA) and Procedural Integrity

IOA data were collected by an independent data collector for 31% of the functional analysis conditions. All functional analysis conditions were

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

videotaped and the independent data collector coded videotapes after the tapes were coded by the primary observer. Agreement was calculated on an exact interval-by-interval basis by dividing the number of agreements by the number of agreements and disagreements and multiplying by 100. Mean IOA was 96.67% (range = 93.33% – 100%). Procedural integrity data were collected for all brief functional analysis conditions and was calculated by dividing the number of procedural steps completed accurately by the total number of procedural steps (contact first author for procedural integrity checklists) and multiplying by 100. Procedural integrity was 100% for all analysis conditions.

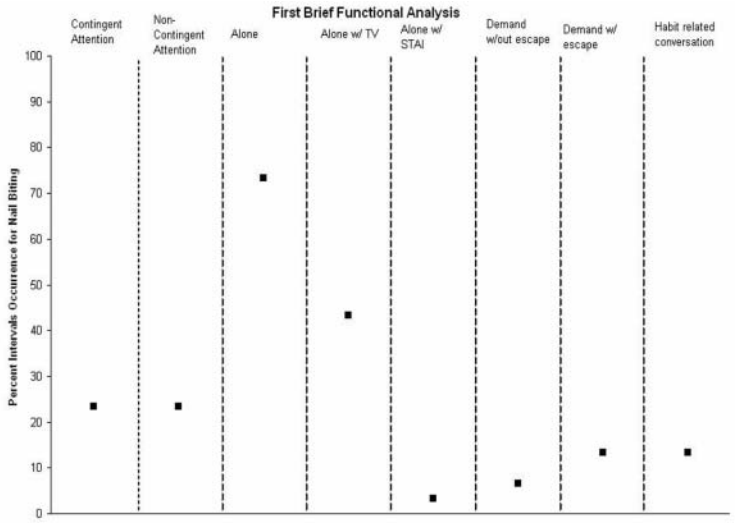
Results

Results of the brief functional analyses are presented in Figures 1 and 2. During the initial brief functional analysis, percentage of intervals in which nail biting occurred was substantially higher during the alone and alone with TV conditions when compared with all other conditions. During the alone condition, nail biting occurred during 73.33% of the intervals while occurring during 43.33% of the intervals during the alone with TV condition. For all other conditions, nail biting occurred during 23.33% or less of the intervals. Two weeks later, during the second brief functional analysis, the percentage of intervals in which nail biting occurred was again highest during the alone and alone with TV conditions (i.e., 66.67% and 86.67%, respectively). Likewise, percentage of intervals for nail biting for all others conditions was substantially lower (i.e., 6.67% of the observed intervals or less). Thus, results across the two brief functional analyses of nail biting were stable and supported the environmental restriction hypothesis and suggested that nail biting was maintained by automatic reinforcement.

Following brief functional analyses, a modified version of SHR was introduced to the client that was based on results from the diagnostic screening and brief functional analyses. SHR packages are reported in various forms in the literature. As stated previously, one goal of this study was to evaluate the usefulness of brief functional analysis data for identifying necessary treatment components. Based on the assessment data, an SHR package was developed that included awareness training, competing response, and social support. Assessment data did not indicate a substantial concern for anxiety, so relaxation training was not included as a replacement behavior in the modified SHR package.

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Figure 1
First Brief Functional Analysis of Nail Biting



Total nail length was measured during the treatment session in which SHR was introduced to the client and was 10.5 cm (See Figure 3). When total nail length was measured during the next treatment session (i.e., following introduction of awareness training), total nail length was 10.4 cm. However, after the complete SHR package was introduced, total nail length increased over the next two treatment sessions. At 1 month follow-up, total nail length was 14.5 cm.

As an adjunct measure of treatment effectiveness, Mandy self-recorded data for frequency of nail biting during 1-hour intervals throughout the day for a period of 4 weeks. Results for self-recorded nail biting and instances in which Mandy "caught" herself before nail biting occurred are presented in Figure 4. Self-recording data are graphed as average frequency per day for a 1-week period. Results from self-recorded data indicate the self-reported frequency of nail biting decreased following introduction of SHR. Additionally, instances of the client "catching" herself just before nail biting were greater than instances of nail biting, but decreased during the

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Figure 2
Second Brief Functional Analysis of Nail Biting

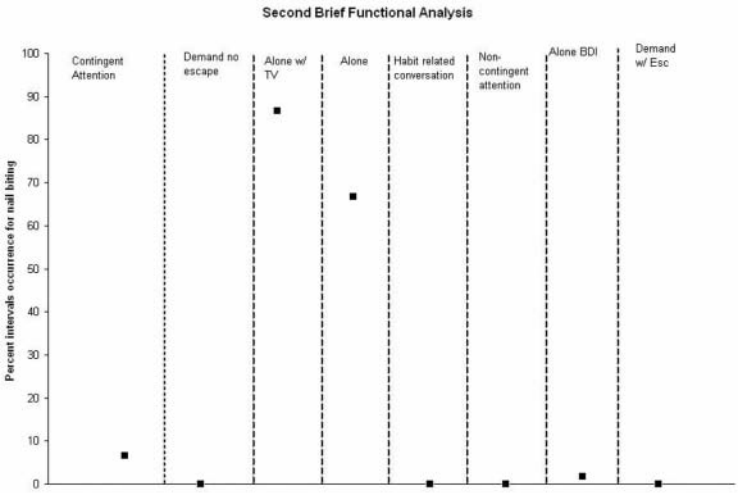
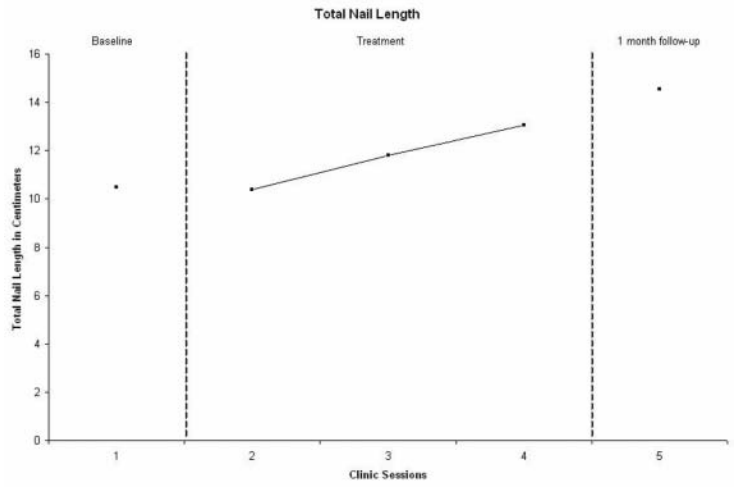
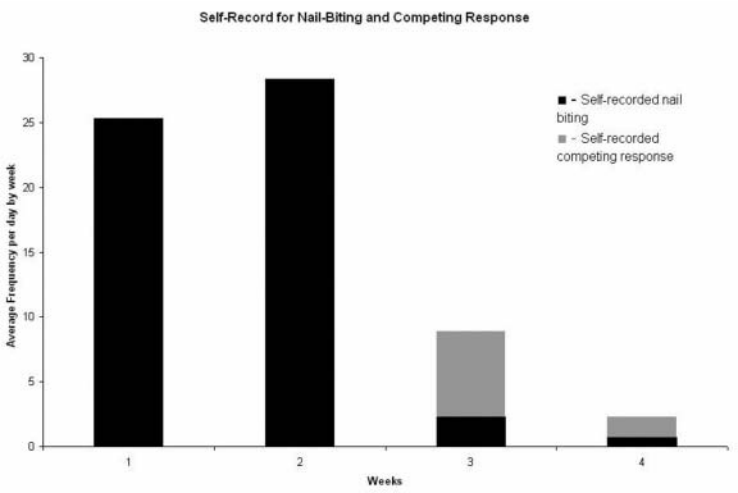


Figure 3
Total Nail Length in Centimeters



Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Figure 4
Self-Record for Engaging in Nail Biting and Competing Response. Weeks 1 and 2 Occurred Before Training for Simplified Habit Reversal, Whereas Weeks 3 and 4 Occurred Following Training



2 weeks of self-recording that occurred following the introduction of SHR which suggests that preemptive behaviors for nail biting (e.g., raising hand to mouth) also decreased.

Discussion

This study bolsters the existing functional analysis literature in some important ways. First, this study adds to the emerging literature supporting functional analysis procedures with novel populations and response topographies. The current study included a female graduate student, whereas previous functional analysis studies have primarily included individuals with developmental disabilities engaging in self-injurious or stereotypical behaviors (Gresham et al., 2004). This study's participant was not only nondisabled but was also potentially high functioning given graduate student status. Additionally, the target behavior for analysis was nail biting. Functional analysis of body-focused repetitive behaviors such as nail biting is a small but growing area of functional analysis research.

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Results from the current study demonstrate that functional analysis manipulations for nail biting may result in variability within the participant across conditions. Therefore, manipulation of temporally proximal events during a short period of time may have an observed effect on nail biting and other habit responses. Also noteworthy is demonstration of the stability of brief functional analysis data over time. Some have questioned the reliability of brief functional analyses that contain only one datum per condition collected during brief sessions (Kahng & Iwata, 1999; Wilder, Normand, & Atwell, 2005). In this study, a brief functional analysis was replicated after 2 weeks, and results from the second analysis were consistent with the first. Other researchers have found that data from brief functional analyses correspond at least moderately with data obtained from extended analyses (Kahng & Iwata, 1999; Tincani, Castrogiavanni, & Axelrod, 1999; Wallace & Knights, 2003) and as a result, may be reliable.

Perhaps the most noteworthy aspect of this study was development and implementation of a treatment package for nail biting that was informed by functional analysis data. A modified SHR package was developed based on the unique characteristics of this study's participant identified during assessment. It may be argued that SHR is effective and robust to behavioral function. However, functional analysis data in this study were used to develop a more economical SHR package. Specifically, relaxation training was not included in the package as functional analysis data did not indicate anxiety reduction as the function of nail biting. As a result, training for SHR was completed in only two treatment sessions. The addition of relaxation training may have added two to three additional sessions of treatment with no additional benefit as nail biting was virtually eliminated by the reduced SHR package. Additionally, the functional analysis identified environmental restriction as the stimulus condition under which nail biting was most likely to occur. Consequently, during awareness training, relevant contextual cues that matched environmental restriction (i.e., alone watching TV) were used to assist the participant in identifying a range of stimuli and behaviors that immediately preceded nail biting. Finally, the therapist encouraged the participant to be especially aware of nail biting while under environmental restriction and to solicit social support during those times.

Limitations and Directions for Future Research

Some limitations included in this study warrant address. First, this study included only one participant and therefore, external validity may be limited. However, in terms of the functional analysis data, results from this study are

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

consistent with previous research that supported an environmental restriction hypothesis for nail biting. Additional research will no doubt continue to confirm or disconfirm the environmental restriction hypothesis for nail biting.

Second, this study sought to extend the nail biting functional analysis literature by including a treatment package developed from functional analysis data. Unfortunately, the nonexperimental design employed in this study to evaluate treatment greatly limits internal validity. Additionally, this study did not include an experimental procedure for evaluating treatment utility of assessment (Hayes, Nelson, & Jarrett, 1987; Nelson-Gray, 2003). To more fully evaluate the treatment utility of functional analysis of nail biting, future studies may include systematic experimental procedures such as those outlined by Hayes et al. (1987) and Nelson-Gray (2003). For example, studies may employ manipulated assessment (e.g., randomly assigning participants to groups that receive varied assessment information) or manipulated use of assessment (e.g., comparison of indicated vs. contraindicated treatments) research procedures to more fully explore the treatment utility of functional analysis for nail biting.

Despite limitations, this study contributes to the growing knowledge base evaluating functional analysis of habits and nail biting in particular. Manipulation of temporally proximal events was observed to affect nail biting. Additionally, analysis data were used to develop a treatment package that was later observed to be effective for substantially reducing nail biting. Finally, the brief analysis procedures included in the study were completed in only one 50-minute clinic session that makes the procedures feasible for routine clinical use.

References

Abel, J. L., Larkin, K. T., & Edens, J. L. (1995). Women, anger, and cardiovascular response to stress. *Journal of Psychosomatic Research*, *39*, 251-259.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *BDI-II manual*. San Antonio, TX: The Psychological Corporation, Harcourt Brace.

Deardorff, P. A., Finch, A. J., Jr., & Royall, L. R. (1974). Manifest anxiety and nail biting. *Journal of Clinical Psychology*, *30*, 378.

De Niro, R. (Producer/Director), Rosenthal, J. (Producer), & Kilik, J. (Producer) (1993). *A Bronx tale* [Motion picture]. United States: Savoy Pictures.

Friman, P. C., Larzelere, R., & Finney, J. W. (1994). Exploring the relationship between thumbsucking and finger sucking. *Journal of Pediatric Psychology*, *19*, 431-441.

Gresham, F. M., McIntyre, L. L., Olson-Tinker, H., Dolstra, L., McLaughlin, V., & Van, M. (2004). Relevance of functional behavioral assessment research for school-based interventions and positive behavioral support. *Research in Developmental Disabilities*, *25*, 19-37.

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Hadley, N. H. (1984). *Fingernail biting: Theory, research, and treatment*. Jamaica, New York: Spectrum.

Hansen, D. J., Tishelman, A. C., Hawkings, R. P., & Doepke, K. J. (1990). Habits with potential as disorders: Prevalence, severity, and other characteristics among college students. *Behavior Modification*, *14*, 66-80.

Hayes, S. C., Nelson, R. O., & Jarrett, R. B. (1987). The treatment utility of assessment: A functional approach to evaluating assessment quality. *American Psychologist*, *42*, 963-974.

Kahng, S., & Iwata, B. A. (1999). Correspondence between outcomes of brief and extended functional analyses. *Journal of Applied Behavior Analysis*, *32*, 149-159.

Klatte, K. M., & Deardorff, P. A. (1981). Nail biting and manifest anxiety of adults. *Psychological Reports*, *48*, 82.

Michael, J. (1993). Establishing operations. *Behavior Analyst*, *16*, 191-206.

Nelson-Gray, R. O. (2003). Treatment utility of psychological assessment. *Psychological Assessment*, *15*, 521-531.

Peterson, A. L., Campose, R. L., & Azrin, N. H. (1994). Behavioral and pharmacological treatments for tic and habit disorders: A review. *Journal of Developmental and Behavioral Pediatrics*, *15*, 430-441.

Silber, K. P., & Haynes, C. E. (1992). Treating nailbiting: A comparative analysis of mild aversion and competing response therapies. *Behaviour Research and Therapy*, *30*, 15-22.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State-Trait Anxiety Inventory (Form Y)*. Palo Alto, CA: Consulting Psychologists Press.

Tincani, M. J., Castrogiavanni, A., & Axelrod, S. (1999). A comparison of the effectiveness of brief versus traditional functional analyses. *Research in Developmental Disabilities*, *20*, 327-338.

Wallace, M. D., & Knights, D. J. (2003). An evaluation of a brief functional analysis format within a vocational setting. *Journal of Applied Behavior Analysis*, *36*, 125-128.

Watson, T. S., & Dufrene, B. A. (2004) Habits and tics: A behavioral approach to assessment and treatment. In B. T. Erford (Ed.), *Professional school counseling: A handbook of theories, programs, and policies* (pp. 569-578). Austin, TX: Pro-Ed.

Watson, T. S., Dufrene, B. A., Weaver, A. D., Butler, T., & Meeks, C. (2005). Brief antecedent assessment and treatment of tics in the regular education classroom: A preliminary investigation. *Behavior Modification*, *29*, 839-857.

Wilder, D. A., Normand, M. P., & Atwell, J. (2005). Non-contingent reinforcement as treatment for food refusal and associated self-injury. *Journal of Applied Behavior Analysis*, *38*, 549-553.

Williams, T. I., Rose, R., & Chisholm, S. (2007). What is the function of nail: An analog assessment study. *Behaviour Research and Therapy*, *45*, 989-995.

Woods, D. W., Fuqua, R. W., Siah, A., Murray, L. K., Welch, M., Blackman, E., et al. (2001). Understanding habits: A preliminary investigation of nail biting function in children. *Education and Treatment of Children*, *24*, 199-216.

Woods, D. W., & Miltenberger, R. G. (1996). Are persons with nervous habits nervous? A preliminary examination of habit function in a nonreferred population. *Journal of Applied Behavior Analysis*, *29*, 259-261.

Woods, D. W., & Miltenberger, R. G. (Eds.). (2001). *Tic disorders, trichotillomania, and other repetitive behavior disorders: Behavioral approaches to analysis and treatment*. Boston: Kluwer.

Woods, D. W., Miltenberger, R. G., & Flach, A. D. (1996). Habits, tics, and stuttering: Prevalence and relation to anxiety and somatic awareness. *Behavior Modification*, *20*, 216-225.

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014

Brad A. Dufrene is an assistant professor in the Department of Psychology at the University of Southern Mississippi. His research interests include functional behavior assessment and direct assessment and intervention for academic skill problems.

T. Steuart Watson is professor and chair of the Department of Educational Psychology at Miami University. His research interests include clinical and school-based applied behavior analysis.

Jennifer S. Kazmerski is a doctoral student in the School Psychology Program at Mississippi State University. Her professional interests include functional behavior assessments, functional interviews, parent training, and assessment and treatment of ADHD.

Downloaded from bmo.sagepub.com at KU Leuven University Library on October 24, 2014