

POSITIVE AND NEGATIVE BEHAVIORAL APPROACHES
USED IN THE TREATMENT OF NAIL-BITING:
AN ANALOGUE STUDY

by

Anna-Marie Davidson
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M.A., University of Kansas, 1974

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INTRODUCTION

Studies of the incidence of nail-biting reveal the extent to which our population is affected by this behavioral problem. Nail-biting has been found to occur most frequently during the age of puberty when incidence figures range from 41 to 51% (Birch, 1955; Malone & Massler, 1952; Wechsler, 1931). Incidence figures from sample populations of college students (Birch, 1955; Coleman & McCalley, 1948; Smith, 1957) indicate that approximately 27% of college populations are nail-biters. Slightly lower percentages have been reported for other adult populations (Pennington, 1945; Pennington & Mearin, 1944).

Investigations concerning the pervasiveness of this problem have resulted in figures ranging from 53 to 66%. That is, well over half of the individuals in adult populations reported that they had been nail-biters during some period of their lives. These figures indicate that the problem of nail-biting is far more prevalent than many other behavioral problems for which specific treatments have been developed and experimentally tested.

Despite the pervasiveness of this behavioral problem, only a limited number of experimentally controlled nail-biting treatment studies appear in the literature. A

large percentage of the reported studies are case studies or studies involving only three or four subjects with no experimental controls. Others are anecdotal reports with an unspecified number of subjects, no objective dependent measures of change, or poorly reported treatment procedures and results. Rather than replicating previously employed procedures, investigators have generally used a variety of treatment procedures. These include such diverse methods as psychoanalysis (Rosow, 1954); hypnotherapy (Gruenewald, 1965); negative practice (Dunlap, 1932; Smith, 1957); self-administered shock and self-recording (Bucher, 1968); threatened loss of money (Stephen & Koenig, 1970); self-monitoring of nail-biting or incompatible responses (McNamara, 1972, 1973); habit reversal (Azrin & Nunn, 1973; Nunn & Azrin, 1976); behavior recording (Maletzky, 1974); sequential self-monitoring, self-punishment, and self-reinforcement (Horan, Hoffman, & Macri, 1974); and covert sensitization (Davidson & Denney, 1976).

Because of the methodological inadequacies of most of these studies, few conclusions can be made. In general, however, motivated adult nail-biters have been able to decrease their nail-biting behaviors under a variety of treatment conditions. Even minimal treatment procedures have shown these decreases. For example, Davidson and Denney (1976) found that an information procedure devised

as an attention-placebo treatment produced substantial changes in nail length. Although these changes were maintained during a 5-week follow-up, the question of whether they would have been maintained over a more extended period remains unanswered. Unfortunately, most research in this area fails to provide adequate follow-up data.

The need for prolonged follow-up data has been underscored by Thoresen and Mahoney (1974), who note that an important aspect of successful treatment of maladaptive behaviors is the maintenance of behavioral changes. Problems in the treatment of nail-biting may be comparable to those encountered in the treatment of other maladaptive behaviors such as smoking, alcoholism, and obesity. For example, recent reviews of the smoking reduction literature (Hunt & Matarazzo, 1973; McFall & Hammen, 1971) indicate that although smoking can be decreased significantly during treatment, these decreases are rarely maintained for more than three months beyond treatment. As in the case of smoking, the problem with nail-biting may lie not so much in effecting change during treatment as in maintaining these changes over extended posttreatment periods.

Preliminary support for this assumption has been contributed by several investigators (Bucher, 1968; Dumlup, 1932; Maletzky, 1974; Smith, 1957; Stephen & Koenig, 1970)

who have presented anecdotal evidence regarding frequent relapses following nail-biting treatment. One could speculate that these relapses are due to the fact that all of the above treatment approaches made use of aversive techniques to suppress nail-biting behavior.

In a discussion of the effects of aversive therapies, Tinling (1972) commented upon the paradoxical bind created by the suppression of behavior, or, as he termed it, by "training in nonbehavior." He contended that suppressive treatments create a behavioral vacuum which is likely to be filled by the same behavior unless alternative behaviors are taught. Wilson and Davison (1972) discussed a related issue regarding the commonly accepted use of aversive techniques to suppress homosexual arousal. They suggested that it is premature to assume that aversive methods must be used to suppress homosexual behaviors before heterosexual interests can be developed. This suggestion may be relevant to the treatment of other maladaptive behaviors as well.

One of the purposes of the present nail-biting study is to serve as an analogue to the treatment of other maladaptive behaviors. Results of this study should help to determine whether suppression of a maladaptive behavior, development of alternative behaviors, or a combination of these approaches is most likely to effect and maintain behavioral change. Thus, two distinctly different

approaches to the treatment of nail-biting were used. The first treatment was similar to previous approaches in that it attempted to suppress nail-biting behavior through the use of aversive techniques. This "negative" approach included training in stimulus control, negative self-verbalizations, and self-punishment procedures described by Goldfried and Merbaum (1973). The second treatment, termed a "positive" approach, attempted to teach a repertoire of alternative responses to nail-biting. This approach included numerous nail and cuticle care procedures, applied relaxation, and hand and finger exercises. According to Tinling's (1972) hypothesis, the positive treatment factor should bring about greater maintenance of behavioral changes.

The present study conformed to a $2 \times 2 + 1$ mixed factorial analysis of variance design. The first and second factors were between-subjects factors consisting of the presence or absence of either positive or negative treatment approaches. The attention-placebo group was added to control for such nonspecific treatment effects as attention, expectancy, and the reactivity associated with behavior recording.

RESULTS

Preliminary Analyses

Mean scores for one subject missing from the positive treatment group were added in order to achieve equal n 's. The deletion of one degree of freedom from the error term had no effect on probability values.

Preliminary analyses which included sex as a factor failed to reveal any significant main effects or interactions. The factor of sex was, therefore, eliminated from all subsequent analyses.

One-way analyses of variance were performed on all pretreatment measures for the five experimental groups. These preliminary analyses were designed to assess initial differences in nail length, cosmetic appearance, and subjects' subjective ratings of their nail-biting problem, as well as general characteristics such as age at which nail-biting began, number and duration of previous attempts to stop nail-biting, motivation for treatment, and proportion of nail-biting attributed to either tension or habit. The five experimental groups failed to demonstrate significant differences on any of these measures. Furthermore, any chance differences in initial pretreatment measures were controlled for through the use of covariance analyses.

METHOD

Subjects

Adult nail-biters were recruited by means of campus and local advertisements. All subjects selected for participation in this study met the following criteria: (a) subjects were at least 18 years of age, (b) subjects currently engaged in nail-biting, (c) subjects considered themselves motivated for treatment, and (d) subjects were willing to deposit a \$10.00 postdated check which would be refunded at the end of the experiment. Initially, 50 subjects (35 females and 15 males) were selected, with 10 subjects randomly assigned to each experimental group. During the first week of the study, one female from the positive treatment group discontinued treatment. The sample of nail-biters included in the study ranged from 18 to 54 years of age with a mean of 26 years.

Pretreatment Session

At an initial pretreatment session, applicants were required to complete a Preliminary Questionnaire designed to assess nail-biting and its determinants, motivation for change, nail and cuticle condition, and availability for treatment sessions (see Appendix A).

All applicants who met the above criteria were accepted as subjects for this study. The subjects signed Consent Forms (see Appendix B) which provided a general description of the study and a brief explanation of experimental procedures. Thus, the subjects were aware of the possibility that they might be assigned to a no-treatment control group. The consent forms also provided an explanation of the \$10.00 deposit requirement with assurance that refund of the deposit would not be contingent upon treatment success but only upon completion of the experiment. Deposits were submitted to the experimenter prior to the measurement of nails.

Each of the subjects' nails was measured to the nearest millimeter with a Vermeer caliper. Nail length measurements were made from the cuticle at the base of the nail to the center-most tip of the nail. An overall nail length score for each subject was obtained by summing the measurements. In addition, each of the subjects' nails was independently rated by two judges using a Cosmetic Appearance Checklist devised by the experimenter (see Appendix C).

A co-experimenter then discussed scheduling difficulties with individual subjects before randomly assigning them to one of the experimental groups. The male to female ratio (3:7) was held constant across the five experimental groups. Four of these groups received

treatment during the study. The following treatment approaches were used: positive, negative, combined positive and negative, and attention-placebo. The remaining experimental group served as a no-treatment control.

Treatment Sessions

Group treatment sessions were scheduled once a week for a period of four weeks. During treatment sessions, the subjects were seated in private cubicles. All treatments and instructions were transmitted from a central control room to headphones worn by the subjects.

At the first session, subjects in each treatment group listened to a description of their specific treatment approach. They were informed that their nails would be measured again at the posttreatment session and were instructed not to cut their nails at any time during the course of treatment. They were advised to be careful while filing or shaping their nails so as not to affect the length any more than necessary. The subjects were further advised that once posttreatment measurements were made, their nails could be kept at whatever length they chose. The subjects then completed an Expectancy Questionnaire, designed to assess their expectations for improvement (see Appendix D). Upon completion of the questionnaire, subjects listened to the first phase of their treatment program. At the end of each treatment

session, subjects were given transcripts of the material presented in that session for continued reference.

Subjects in all treated groups were asked to record the amount of time their attention was focused upon their own or others' nails. In addition to recording attention-focusing behaviors, subjects in the positive and negative treatment groups recorded, on a daily basis, time spent in practicing the procedures relevant to their specific treatment approach or approaches. The Daily Recording Charts were collected at subsequent treatment sessions.

All experimental information, group assignments, and scheduling dates were presented in printed form. Thus, subjects had minimal contact with the experimenter.

Positive approach. Each of the positive treatment sessions lasted approximately 15 minutes. At the first session, subjects listened to a treatment rationale for developing a repertoire of positive alternative behaviors to replace their nail-biting behavior. This was accomplished through the use of instructional material designed to teach procedures for nail and cuticle care. The procedures were presented in the following order: Week #1, facts about the structure and function of nails; Week #2, intensive nail and cuticle care procedures; Week #3, applied relaxation and hand and finger exercises; Week #4, hand massage and manicure procedures. Knowledge of these procedures was cumulative during the course of treatment. Although subjects were advised to try each of the

procedures at least once, they were encouraged to consistently practice those procedures which were most appropriate for their particular nail and cuticle problems.

In addition to recording attention-focusing behaviors, subjects in this group were instructed to use their Daily Recording Charts to record time spent in practicing the nail care procedures.

Negative approach. Each of the negative treatment sessions lasted approximately 15 minutes. At the first session, subjects listened to a treatment rationale for learning to suppress their nail-biting behavior. Then, during each of the four treatment sessions, they were instructed in the use of a different suppressive procedure. These procedures were presented in the following order: Week #1, stimulus control; Week #2, aversive imagery; Week #3, negative self-verbalizations; Week #4, self-punishment. Each presentation included specific suppressive suggestions. For example, training in stimulus control included several suggestions for limiting the act of nail-biting to a particular time and place. During the aversive imagery sessions, subjects were instructed to imagine themselves in a variety of situations in which they were embarrassed at being seen biting their nails. Negative verbalizations involved repetitions of such statements as, "I must not bite my nails," and "It is childish of me to chew on my nails." Subjects were

instructed to engage in such self-punishing behaviors as, burning a dollar bill, snapping a rubber band worn on their wrists, or telling a nearby stranger that they were a nail-biter each time they actually bit their nails. Although subjects were advised to try each of the procedures at least once, they were encouraged to consistently practice those procedures which most effectively suppressed their nail-biting behavior.

In addition to recording attention-focusing behaviors, subjects in this group were instructed to use their Daily Recording Charts to record time spent in practicing the suppressive procedures.

Combined positive and negative approaches. Subjects in this group received both the positive and negative treatments. At each session, a component of the negative treatment was presented just prior to presentation of the positive treatment. Thus, total time for each treatment session was approximately 30 minutes. Each rationale (as previously described) was explained during the introductory phase of each treatment approach.

In addition to recording attention-focusing behaviors, subjects in this group were instructed to use their Daily Recording Charts to record time spent in practicing both the positive and negative treatment procedures.

Attention-placebo approach. Each of the attention-placebo treatment sessions lasted approximately 15 minutes.

At the first session, subjects listened to a treatment rationale for learning factual information about their nails and nail-biting behavior. The information was presented in the following order: Week #1, facts about the structure and function of nails; Week #2, nail diseases and disorders; Week #3, incidence figures from nail-biting surveys; Week #4, etiological theories concerning nail-biting. Subjects in this group recorded only the amount of time their attention was focused on their own or others' nails. These recordings were made on Daily Recording Charts.

No-treatment control. Group assignment cards received at the pretreatment session informed subjects in this group that they were not scheduled for treatment during the study. The date of the posttreatment session was given and subjects were reminded that their continued participation at posttreatment and follow-up sessions would be sufficient to warrant the return of their deposits. They were also informed that participation in this experimental study would make them eligible for a nail-biting treatment program being conducted at a later date.

Posttreatment Sessions

The posttreatment sessions were held five weeks after the initial pretreatment session. During these sessions, each of the subjects' nails was measured and

rated in accordance with the pretreatment procedures. All measurements and ratings were made without knowledge of previous measurements, ratings, or group assignments. All subjects completed Posttreatment Questionnaires designed to assess the degree to which nail-biting remained a problem (see Appendix E).

All subjects received printed cards stating that they would be notified of the scheduled date of the follow-up session. The cards informed the subjects that their nails would be measured again at follow-up and that their deposits would be returned upon completion of the final session.

Follow-Up Sessions

Four months after the posttreatment sessions, each of the subjects' nails was again measured and rated according to previously described procedures. Subjects were asked to complete Follow-Up Questionnaires which assessed the degree to which nail-biting remained a problem (see Appendix F).

During a debriefing phase at the end of the follow-up session, the experimental treatment modalities were described to each group and deposits were returned. Subjects in the no-treatment control group (and other subjects who failed to profit from earlier treatment) were given the opportunity to receive treatment by means of the combined positive and negative approaches.

Additional preliminary analyses were performed on data obtained from the four groups receiving treatment during the course of the study (i.e., the positive, negative, combined positive and negative, and placebo groups). There were no significant differences between the four groups regarding their understanding of the treatment rationale, confidence in the treatment program, or expectation of success.

Objective Dependent Measures

Nail length measurements for the five experimental groups are presented in Table 1. A 2 (positive) X 2 (negative) + 1 (placebo) analysis of covariance of post-treatment nail length measures revealed a significant interaction between positive and negative treatment factors, $F(1, 44) = 4.32, p < .05$. Duncan's pairwise comparisons were performed in order to interpret the interaction between the positive and negative factors. These comparisons revealed that the three groups receiving either the positive and/or negative treatment had significantly longer nails than the no-treatment controls, $p < .01$. Pairwise comparisons were then made between the five experimental groups, including the placebo group.¹ The placebo group differed from the controls, $p < .01$,

¹Error terms from the 1 X 5 analyses of covariance were used in this and in all subsequent comparisons of the five experimental groups.

Table 1
 Mean Nail Length Measurements (in Centimeters)
 with Standard Deviations and Adjusted Means

| Measurements | Positive | Negative | Combined | Placebo | Control |
|-------------------------------|----------|----------|----------|---------|---------|
| Pretreatment | | | | | |
| \bar{X} | 9.29 | 8.80 | 8.77 | 7.35 | 7.78 |
| SD | 1.95 | 1.50 | 2.36 | 2.12 | 1.32 |
| Posttreatment | | | | | |
| \bar{X} | 11.09 | 10.17 | 10.35 | 8.74 | 7.86 |
| SD | 2.07 | 2.33 | 2.91 | 2.74 | 1.33 |
| Adjusted Posttreatment | | | | | |
| \bar{X} | 10.07 | 9.71 | 9.93 | 9.92 | 8.56 |
| Follow-Up | | | | | |
| \bar{X} | 10.98 | 9.81 | 10.21 | 8.73 | 7.92 |
| SD | 1.78 | 1.93 | 2.92 | 3.41 | 1.43 |
| Adjusted Follow-Up | | | | | |
| \bar{X} | 9.98 | 9.36 | 9.80 | 9.90 | 8.61 |

but did not differ significantly from the other three treated groups.

A similar analysis of covariance performed on follow-up nail length measures disclosed only a main effect for the positive treatment factor, $F(1, 44) = 6.75, p < .025$. Pairwise comparisons of the five experimental groups revealed that the four treated groups still did not differ significantly from each other at follow-up. However, nail length measures of the negative group were no longer significantly greater than those of the no-treatment controls. All other treated groups, including the placebo group, differed from the controls at the .05 level of significance.

Posttreatment and follow-up nail length measures were then subjected to a 2 (positive) X 2 (negative) X 2 (trials) + 1 (placebo) analysis of covariance. Results of this analysis revealed no significant main effects or interactions involving trials, indicating that nail length did not change appreciably from posttreatment to follow-up.

Cosmetic appearance ratings for the five experimental groups are presented in Table 2. Pretreatment ratings made by two independent raters were highly correlated, $r(49) = .99, p < .001$. Thereafter, ratings were made by the second rater only. Pretreatment ratings made by the second rater were used for the analyses. A 2 (positive) X 2 (negative) + 1 (placebo) analysis of covariance was

Table 2
 Mean Cosmetic Appearance Ratings with Standard
 Deviations and Adjusted Means

| Ratings | Positive | Negative | Combined | Placebo | Control |
|------------------------|----------|----------|----------|---------|---------|
| Pretreatment | | | | | |
| \bar{X} | 32.30 | 32.00 | 38.80 | 38.40 | 40.80 |
| SD | 9.73 | 8.84 | 9.83 | 10.22 | 11.37 |
| Posttreatment | | | | | |
| \bar{X} | 13.10 | 20.40 | 17.70 | 24.40 | 40.20 |
| SD | 7.29 | 13.28 | 10.96 | 15.13 | 9.00 |
| Adjusted Posttreatment | | | | | |
| \bar{X} | 16.04 | 23.55 | 16.05 | 23.03 | 37.14 |
| Follow-Up | | | | | |
| \bar{X} | 14.30 | 24.30 | 22.70 | 27.60 | 42.30 |
| SD | 8.64 | 14.92 | 12.13 | 18.19 | 10.34 |
| Adjusted Follow-Up | | | | | |
| \bar{X} | 17.02 | 27.22 | 21.17 | 26.33 | 39.46 |

performed on posttreatment cosmetic appearance ratings. This analysis revealed a significant interaction between the positive and negative treatment factors, $F(1, 44) = 4.96$; $p < .05$. Pairwise comparisons of the negative and positive treatment factors revealed that cosmetic ratings for the three groups receiving the positive and/or negative treatments were significantly better than those of the no-treatment controls, $p < .05$. In addition, cosmetic ratings of both groups receiving the positive treatment component were significantly better than those of the group receiving only the negative treatment, $p < .05$. Pairwise comparisons that included the placebo group indicated that the placebo group differed from the controls, $p < .01$, but did not differ significantly from any of the other treated groups.

A similar analysis of covariance performed on follow-up cosmetic ratings again revealed a significant interaction between the positive and negative treatment factors, $F(1, 44) = 4.77$, $p < .05$. Pairwise comparisons disclosed that cosmetic ratings for the three treated groups were significantly better than those for the controls, $p < .05$. Although the two groups receiving the positive treatment component still did not differ significantly from each other at follow-up, only the ratings of the positive treatment group remained significantly better than those of the negative group, $p < .05$. Pairwise comparisons

that included the five experimental groups revealed that the placebo group also differed from the controls at the .05 level but did not differ significantly from the negative and combined treatment groups. Differences between the placebo and positive treatment groups approached significance at the .10 level, indicating that, at follow-up, the nails and cuticles of subjects in the positive group tended to be rated slightly higher than those of the placebo group.

Means for posttreatment and follow-up ratings were then analyzed by means of a 2 (positive) X 2 (negative) X 2 (trials) + 1 (placebo) analysis of covariance. This analysis revealed only a main effect for trials, $F(1, 45) = 4.75$, $p < .05$, indicating that the appearance of subjects' nails and cuticles deteriorated significantly from post-treatment to follow-up.

To summarize, nail length increased significantly for all treated groups. There were no significant differences in nail length between the four treated groups at posttreatment. While the nails of subjects in the positive, combined, and placebo groups were significantly longer at follow-up than those of the no-treatment controls, the nails of subjects in the negative treatment group were not.

Objective ratings of the cosmetic appearance of subjects' nails and cuticles also improved significantly

for all treated groups. While posttreatment ratings of the placebo group did not differ from those of the other three treated groups, posttreatment ratings of the two groups receiving the positive treatment component were significantly better than those of the negative group. At follow-up, all treated groups continued to maintain the cosmetic appearance of their nails and cuticles better than the controls. In addition, the nails and cuticles of subjects in the positive treatment group were rated significantly higher than those of subjects in the negative group.

Subjective Dependent Measures

Data concerning self-reported frequency of nail-biting are presented in Table 3. Posttreatment ratings of nail-biting occurrences were subjected to a 2 (positive) X 2 (negative) + 1 (placebo) analysis of covariance. Results revealed a significant interaction between positive and negative treatment factors, $F(1, 44) = 4.66$, $p < .05$. Pairwise comparisons showed that the three groups being treated by means of the positive and/or negative treatments reportedly bit their nails less frequently than the controls, $p < .05$. Pairwise comparisons that included the five experimental groups revealed that the placebo group also differed from the controls at the .05 level of significance but did not differ significantly from the other three treated groups.

Table 3
Mean Daily Frequency of Nail-Biting

| Frequency | Positive | Negative | Combined | Placebo | Control |
|-------------------------------|----------|----------|----------|---------|---------|
| Pretreatment | | | | | |
| \bar{X} | 2.60 | 2.40 | 2.50 | 3.60 | 3.60 |
| SD | 1.10 | 1.00 | 1.00 | 1.40 | 1.40 |
| Posttreatment | | | | | |
| \bar{X} | 1.60 | 1.60 | 1.90 | 1.90 | 3.00 |
| SD | 1.00 | .70 | 1.00 | .90 | 1.30 |
| Adjusted Posttreatment | | | | | |
| \bar{X} | 1.70 | 1.70 | 2.00 | 1.80 | 2.90 |
| Follow-Up | | | | | |
| \bar{X} | 1.60 | 2.10 | 2.00 | 1.80 | 2.80 |
| SD | .70 | 1.20 | .80 | 1.00 | 1.00 |
| Adjusted Follow-Up | | | | | |
| \bar{X} | 1.70 | 2.30 | 2.10 | 1.60 | 2.60 |

Note. Scale: 1 = less than 1; 2 = 1-5; 3 = 6-10;
4 = 11-15; 5 = more than 15.

Follow-up ratings of nail-biting occurrences were then subjected to a similar analysis of covariance. Results of this analysis revealed no significant main effects or interactions.

A 2 (positive) X 2 (negative) X 2 (trials) + 1 (placebo) analysis of covariance was performed on post-treatment and follow-up ratings. There was no significant main effect or interaction involving trials, indicating that frequency of nail-biting did not change from post-treatment to follow-up.

Means for subjects' ratings of the appearance of their nails and cuticles are shown in Table 4. A 2 (positive) X 2 (negative) + 1 (placebo) analysis of covariance performed on the posttreatment ratings revealed a highly significant interaction between the positive and negative treatment factors, $F(1, 44) = 11.60, p < .005$. Pairwise comparisons revealed that the three groups being treated by means of the positive and/or negative treatments reported significantly higher nail and cuticle appearance ratings than the controls, $p < .05$. However, ratings of the three treated groups were not significantly different from each other. Pairwise comparisons of the five experimental groups indicated that while ratings of the placebo group differed from those of the controls, $p < .05$, they did not differ significantly from those of the other three treated groups.

Table 4
 Mean Subjective Ratings of Nail
 and Cuticle Appearance

| Ratings | Positive | Negative | Combined | Placebo | Control |
|-------------------------------|----------|----------|----------|---------|---------|
| Pretreatment | | | | | |
| \bar{X} | 14.20 | 46.90 | 47.40 | 23.60 | 27.30 |
| SD | 19.10 | 43.80 | 34.10 | 33.00 | 46.20 |
| Posttreatment | | | | | |
| \bar{X} | 113.80 | 117.20 | 105.80 | 88.80 | 27.00 |
| SD | 52.50 | 44.50 | 49.70 | 60.90 | 34.10 |
| Adjusted Posttreatment | | | | | |
| \bar{X} | 120.30 | 111.70 | 100.10 | 91.80 | 28.70 |
| Follow-Up | | | | | |
| \bar{X} | 101.90 | 87.60 | 75.10 | 76.30 | 27.40 |
| SD | 28.00 | 55.30 | 48.50 | 58.10 | 35.20 |
| Adjusted Follow-Up | | | | | |
| \bar{X} | 111.80 | 79.20 | 66.40 | 80.90 | 30.00 |

An analysis performed on follow-up ratings again disclosed a highly significant interaction between the treatment factors, $F(1, 44) = 12.28$, $p < .001$. Pairwise comparisons revealed that the three groups receiving the positive and/or negative treatments differed significantly from the no-treatment controls, $p < .05$. In addition, the positive group rated the appearance of their nails and cuticles significantly higher than the combined treatment group, $p < .05$, and displayed a tendency toward higher ratings than the negative group, $p < .10$. Pairwise comparisons including the placebo group indicated that while the placebo group differed from the controls, $p < .05$, it did not differ significantly from the other treated groups.

Subjects' posttreatment and follow-up ratings were then subjected to a 2 (positive) X 2 (negative) X 2 (trials) + 1 (placebo) analysis of covariance. Results revealed only a significant main effect for trials, $F(1, 45) = 5.29$, $p < .03$. In general, subjects were not as pleased with the appearance of their nails and cuticles at follow-up as they had been at posttreatment.

Subjects' ratings of their control over the problem of nail-biting are presented in Table 5. Posttreatment ratings of control were analyzed by means of a 2 (positive) X 2 (negative) + 1 (placebo) analysis of covariance. This analysis again revealed a highly significant interaction

Table 5
 Mean Subjective Ratings of Control
 Over Nail-Biting

| Ratings | Positive | Negative | Combined | Placebo | Control |
|-------------------------------|----------|----------|----------|---------|---------|
| Pretreatment | | | | | |
| \bar{X} | 14.70 | 17.40 | 26.90 | 20.20 | 15.50 |
| SD | 22.80 | 15.60 | 19.80 | 15.90 | 19.40 |
| Posttreatment | | | | | |
| \bar{X} | 71.00 | 67.40 | 59.10 | 56.70 | 16.90 |
| SD | 29.00 | 32.60 | 24.60 | 30.80 | 19.00 |
| Adjusted Posttreatment | | | | | |
| \bar{X} | 72.00 | 67.70 | 57.30 | 56.40 | 17.70 |
| Follow-Up | | | | | |
| \bar{X} | 67.40 | 48.80 | 51.20 | 53.20 | 25.00 |
| SD | 29.50 | 29.60 | 25.80 | 36.70 | 30.00 |
| Adjusted Follow-Up | | | | | |
| \bar{X} | 69.00 | 49.40 | 48.30 | 52.80 | 26.30 |

between the positive and negative treatment factors, $F(1, 44) = 13.48, p < .001$. While the three groups receiving the positive and/or negative treatments did not differ significantly from each other, they again differed from the no-treatment controls, $p < .05$. Pairwise comparisons that included the placebo group resulted in similar findings. That is, while ratings of control over nail-biting made by the placebo group did not differ significantly from those made by the other treated groups, they did differ from those made by the control group, $p < .05$.

An analysis performed on subjects' ratings of control at follow-up again disclosed a significant treatment interaction, $F(1, 44) = 5.29, p < .05$. Pairwise comparisons of the groups included in the factorial design indicated that the positive group was the only group that still reported significantly greater control over their nail-biting than the no-treatment controls, $p < .05$. Differences between the controls and both the negative and combined treatment groups merely approached significance, $p < .10$. Follow-up ratings of control made by the placebo group were not significantly different than those made by the other three treated groups. However, differences between ratings made by the placebo group and those of the no-treatment control group only approached significance, $p < .10$.

Posttreatment and follow-up ratings of control were then analyzed by means of a 2 (positive) X 2 (negative) X 2 (trials) + 1 (placebo) analysis of covariance. This analysis failed to reveal any significant main effect or interactions involving the trials factor. Thus, perceived control over nail-biting did not change significantly from posttreatment to follow-up.

To summarize, at posttreatment, the four treated groups reported less nail-biting, greater satisfaction with the appearance of their nails and cuticles, and more control over their nail-biting behavior than the no-treatment controls. The treated groups did not differ significantly from each other on any of the posttreatment subjective measures. These results are consistent with those obtained from posttreatment analyses of the objective dependent measures. As expected, results for the follow-up data were somewhat different. At follow-up, there were no significant differences in the reported frequency of nail-biting for any of the five experimental groups. However, subjects in the positive group were more pleased with the appearance of their nails and cuticles than either the combined treatment group or the controls. The positive group also tended to rate their nails and cuticles higher than the negative group. Furthermore, at follow-up, the positive group was the only group that felt significantly more control over their nail-biting

behavior than the controls. All other treated groups revealed only a tendency toward greater control.

Supplementary Measures

Supplementary measures of subjects' involvement in the process of treatment were available for the four treated groups only. Table 6 represents mean weekly self-report measures of the amount of time subjects paid attention to their own or others' nails and time spent in practicing specific procedures during the four-week treatment program.

Measures of attention-focusing were analyzed by means of a 4 (treatments) X 4 (weeks) analysis of variance. This analysis revealed significant main effects for treatment, $F(3, 36) = 4.93$, $p < .006$, and for weeks, $F(3, 108) = 5.26$, $p < .002$. Subjects in both the positive and the combined treatment groups paid more attention to their nails than subjects who did not receive the positive treatment. While subjects receiving the positive treatment component reportedly spent an average of 44 minutes each week attending to their nails, subjects in the negative and placebo groups reported spending an average of only 19 minutes each week. The main effect for weeks indicated that subjects generally paid less attention to their nails as treatment progressed.

Measures representing the amount of time the negative and combined treatment groups spent in practicing the

Table 6
 Mean Weekly Subjective Ratings of Practice
 (in Minutes) of Treatment Procedures

| Behaviors recorded | Positive | Negative | Combined | Placebo |
|----------------------------|----------|----------|----------|---------|
| Attention-focusing | | | | |
| Week #1 | 50 | 21 | 54 | 25 |
| Week #2 | 42 | 19 | 51 | 16 |
| Week #3 | 38 | 17 | 43 | 14 |
| Week #4 | 34 | 16 | 42 | 21 |
| Positive procedures | | | | |
| Week #1 | 13 | | 13 | |
| Week #2 | 12 | | 13 | |
| Week #3 | 14 | | 10 | |
| Week #4 | 13 | | 12 | |
| Negative procedures | | | | |
| Week #1 | | 5 | 17 | |
| Week #2 | | 5 | 17 | |
| Week #3 | | 7 | 14 | |
| Week #4 | | 6 | 12 | |

negative procedures were subjected to a 2 (treatments) X 4 (weeks) analysis of variance. There was no significant interaction. However, the analysis revealed a significant main effect for treatment, $F(1, 18) = 4.95$, $p < .05$, indicating that the combined treatment group spent more time practicing the negative procedures than the group receiving the negative treatment only.

A similar analysis was performed on measures representing the amount of time the positive and combined treatment groups spent in practicing the positive procedures. Results of this analysis revealed no significant differences between the two groups.

In summary, groups receiving the positive treatment component paid more attention to their own or others' nails than groups receiving either negative or placebo treatments. However, as treatment progressed, time spent in attending to nails decreased across all of the treatment groups. Although there were no differences between the two groups practicing the positive procedures, the combined treatment group spent more time practicing the negative procedures than did the negative group.

Other supplementary measures reflected treated subjects' ratings of their involvement in the treatment program and ratings of the probability that nail-biting would become a problem in the future. Mean posttreatment and follow-up ratings on each of these variables are

shown in Tables 7 and 8. Posttreatment ratings of involvement made by subjects in the four treatment groups were analyzed by means of a one-way analysis of variance. This analysis revealed no significant differences between the four treated groups. However, an analysis of similar ratings made at follow-up revealed a significant difference between the four treated groups, $F(3, 36) = 3.57$, $p < .02$. Duncan's pairwise comparisons of the four groups disclosed no significant differences between the positive and combined treatment groups. While both the positive and the combined treatment groups reported significantly more involvement in treatment than the negative group, $p < .05$, differences between these two groups and the placebo group only approached significance, $p < .10$.

Posttreatment and follow-up ratings of involvement were then subjected to a 4 (treatments) X 2 (trials) analysis of variance. Results disclosed a highly significant main effect for trials, $F(1, 36) = 23.75$, $p < .001$. Subjects in all treated groups felt more involved in their treatment programs at posttreatment, $\bar{X} = 66\%$, than they did at follow-up, $\bar{X} = 40\%$.

Subjects' posttreatment and follow-up ratings of the probability that their nail-biting would recur were subjected to a similar series of analyses. Results of these analyses revealed no significant main effects or interactions.

Table 7
 Mean Subjective Ratings of Involvement in Treatment

| Trial | Positive | Negative | Combined | Placebo |
|---------------|----------|----------|----------|---------|
| Posttreatment | 75% | 58% | 71% | 61% |
| Follow-up | 55% | 21% | 53% | 31% |

Table 8
 Mean Subjective Ratings of Probability of
 Nail-Biting Recurrence

| Trial | Positive | Negative | Combined | Placebo |
|---------------|----------|----------|----------|---------|
| Posttreatment | 44% | 38% | 40% | 49% |
| Follow-up | 45% | 57% | 60% | 52% |

In general, analyses of subjective ratings of involvement revealed that all treated groups felt equally involved during the course of treatment. At follow-up, however, both groups receiving the positive treatment component felt significantly more involved than the negative group and slightly--though not significantly--more involved than the placebo group. As expected, subjects in all treated groups considered themselves less involved at follow-up than at posttreatment.

Regression Analyses

Step-wise multiple regression analyses were performed to determine if any of the measures taken at pretreatment predicted treatment success as indicated by nail length. Five regression analyses were performed, one for each of the four individual treatment groups and one for all four treatment groups combined. In the first step of the analyses, pretreatment nail length measures were "forced" into the equation. The remainder of the variables were allowed to enter the equation only if they added significantly to the proportion of variance not accounted for by the pretreatment nail length measures. Table 9 presents the percentage of variance accounted for by each of the pretreatment variables. It can be seen that pretreatment nail length accounted for a high percentage of posttreatment nail length within and across all conditions. Moreover, only two of the other variables predicted

Table 9
 Preretreatment Variables That Predicted Nail Length Improvement^a

| Variables | Positive | Negative | Combined | Placebo | Overall Analysis |
|-------------------------------------|----------|----------|----------|---------|---------------------|
| Pretreatment nail length | .797 | .888 | .891 | .801 | .821 |
| Present age | .062 | .044 | | .015 | |
| Age at which nail-biting began | | | | | |
| Interest in stopping | .013 | | | | |
| Number of previous attempts to stop | | | | | |
| Greatest length of time stopped | | | .045 | | .014 |
| Biting attributed to tension | | | | | |
| Biting attributed to habit | .050 | | .015 | .024 | |
| Understanding of treatment | | | | | |
| Reasonableness of treatment | .027 | | | .099 | |
| Expected improvement | | | .037 | | .034 |
| Confidence in treatment | | .015 | | .055 | |
| Involvement in treatment | .049 | | | | |
| Attention-focusing during treatment | | .042 | | | .025 |

^aNumbers in the table represent the percentage of variance accounted for by variables that predicted at least one percent of the total variance.

treatment success in even three of the four treated groups. Both age and biting attributed to habit were positively correlated with posttreatment nail length measures, suggesting that treatment success may improve for older subjects and for subjects who feel that their nail-biting is an habitual behavior.

It should be noted, however, that neither age nor biting attributed to habit accounted for a large percentage of the overall variance. This probably results from two factors. First, there were relatively few subjects in each treatment group. And second, pretreatment nail length was an excellent predictor of success--always accounting for at least 80% of the total variance; thus little variance remained to be accounted for by any of the other variables.

DISCUSSION

Each of the four treatment approaches used in the present study produced significant change in nail-biting behavior during treatment. These results were consistent with those of previous nail-biting treatment studies (Bucher, 1968; Davidson & Denney, 1976; McNamara, 1972, 1973; Smith, 1957; Stephen & Koenig, 1970). In these studies, a variety of treatment approaches brought about change during treatment but failed to demonstrate differential treatment effectiveness.

In the present study, nail length measurements of the four treated groups failed to differ significantly at either posttreatment or follow-up. The positive "nail care" approach did, however, tend to effect slightly greater changes in nail length than the negative "suppressive" approach. This same trend is reflected in group means for all of the dependent measures. Means for the positive treatment groups were generally greater--though in some cases, not significantly so--than those of the other three treated groups. Means for the combined treatment group were usually only slightly greater than those for the placebo group, with the negative treatment group means showing the least amount of improvement. At follow-up, the nails of subjects in the negative treatment group

were not significantly longer than those of subjects in the no-treatment control group. These results support Tinling's (1972) hypothesis that long-term behavioral changes are not sufficiently maintained by the use of aversive procedures that merely attempt to suppress the maladaptive behavior itself. In the present study, subjects who did not receive the positive treatment component paid less attention to their nails, spent less time practicing the treatment procedures, and also indicated that they felt less involved in their treatment program than subjects who received the positive treatment component. Thus, aversive procedures may actually encourage individuals to avoid thinking about their maladaptive behaviors, leaving them less amenable to change.

The combined treatment, using positive and negative treatments simultaneously, was expected not only to effect greater change in nail length, but also to maintain these changes over an extended follow-up period. However, neither treatment effectiveness nor maintenance of treatment effects were significantly enhanced even though sessions for the combined approach lasted twice as long as those for the single treatment approaches. In general, mean scores for the combined group tended to be slightly--though not significantly--lower than those for the group receiving only the positive treatment, indicating that the addition of suppressive procedures adversely affected

treatment. These results were similar to those obtained by Davidson and Denney (1976). In one treatment condition, these investigators combined aversive covert sensitization with a neutral procedure which provided subjects with information about their nails. The aversive procedure actually detracted from the effectiveness of the neutral procedure alone. Results of these studies raise some doubt about the advisability of administering both positive and negative treatments simultaneously. The combination of radically different approaches appears to cause a split in the focus of treatment which is detrimental to both immediate and long-term behavioral change.

Although the evidence presented in this study leads one to seriously question the use of aversive procedures, it should be noted that such procedures may be very appropriate in certain clearly defined situations. In the present investigation, treatments were administered to individuals who were highly motivated to change their nail-biting behavior. When this is not the case --as with children who engage in dangerously destructive behavior such as head banging--an aversive approach may be required in order to rapidly extinguish the self-injurious behavior pattern. However, once the destructive behavior has been suppressed by means of an external control agent, a positive approach should be employed to enhance the individual's sense of internal control. This

sequence of treatment approaches would extend the effects of treatment and insure long-term behavioral change. These suggestions are made in accordance with Thoresen and Mahoney's (1974) contention that it is far more efficacious to help individuals to develop a sense of self-control than to promote further dependency upon external controls.

Since the present study was intended as an analogue treatment study, it is hoped that these findings will stimulate interest in the development of positive approaches to the treatment of other maladaptive behaviors as well. It may be possible, for example, to develop procedures for encouraging heterosexual interests in homosexuals without first suppressing their homosexual behaviors (Wilson & Davison, 1974). This might be accomplished through training in social and dating skills and through the use of pictures and information which focus attention upon the form and function of both male and female bodies. In developing a positive approach to the treatment of obesity, one might focus attention upon the goal of weight loss through pictures and information about appearance, grooming, posture, fashions, nutrition, exercise, health, etc. Such positive procedures are likely to be more effective than suppressive techniques in bringing about long-term behavior changes--particularly when individuals are already motivated to change their maladaptive behaviors.

During the present investigation, a number of incidents provided anecdotal evidence which helps to confirm that motivated individuals are capable of changing their own behavior. In one instance, the 11-year-old daughter of a female assigned to the positive treatment group completely eliminated her nail-biting behavior by simply following the self-instructional nail and cuticle care materials given to her mother. She was able to change her own behavior even though she attended none of the experimental treatment sessions. Several other subjects mentioned that they had loaned their instructional materials to friends who were successfully using the procedures on their own. In addition, a number of subjects, who had inadvertently returned to nail-biting during a stressful period, either began using the written material anew or expressed an intention of doing so at some future date. These incidents encourage the development of self-instructional programs. Like Thoresen and Mahoney (1974), this investigator would prefer to discard the term "treatment" and to think, instead, of teaching new behaviors that will help motivated individuals to change their own maladaptive behaviors. Thoresen and Mahoney maintain that self-instructional programs are ideal for this purpose. Such programs not only decrease dependency upon external sources, but also allow individuals to gain a sense of self-control that is vital to the maintenance of behavioral changes.

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APPENDICES

8. What has been the longest period of time that you have been able to stop biting your nails? _____
9. Approximately what proportion of your nail-biting behavior serves to reduce tension or anxiety?
100% of it... _____ ...0% of it
10. Approximately what proportion of your nail-biting occurs without conscious awareness (i.e., as an unconscious habit)?
0% of it... _____ ...100% of it

Name _____

Address _____

Phone # _____

Sex _____ Age _____

APPENDIX B

CONSENT FORM

By signing this consent form, I will become a participant in an experiment involving several approaches to the treatment of nail-biting. I understand that I will be assigned to one of five experimental groups. In order to meet research requirements, one of the five groups will be a "no-treatment control group." My chances of being assigned to the no-treatment group are one in five. However, if I am assigned to the no-treatment group for this experiment, I will be given the opportunity for treatment at a later date.

I am prepared to deposit a \$10.00 check (postdated by 6 months) with the experimenter. I understand that my check will be returned to me upon completion of this experiment regardless of whether or not I have achieved success in treatment. If I should drop out of the experiment at any time before the final session, I will forfeit my deposit.

As a participant in this experiment, I shall make a serious effort to attend all scheduled group sessions and, if necessary, I will reschedule sessions I am unable to attend. All treatment sessions will be scheduled for Monday evenings, beginning November 3rd.

Signed _____
 Phone # _____ Sex _____
 Address _____

APPENDIX C

COSMETIC APPEARANCE CHECKLIST

CUTICLES

1. Cuticle is red, swollen, or sore.
2. Cuticle is ragged, cracked, or split.
3. Cuticle extends onto nail

NAILS

1. Nail bitten to the nail body.
2. Nail bitten into the nail body.
3. Free edge of nail is ragged or split.

APPENDIX D

EXPECTANCY QUESTIONNAIRE

1. How completely do you understand the rationale for the nail-biting treatment you are about to receive?
not at all... _____ ...completely
2. To what extent does the treatment rationale for eliminating your nail-biting seem reasonable to you?
completely... _____ ...not at all
3. How would you assess your expectations for success?
0% chance... _____ ...100% chance
4. Estimate what percentage of the success you achieve will be due to the fact that you know that your nails will be measured at the end of treatment?
100% of it... _____ ...0% of it
5. Estimate what percentage of the success you achieve will be due to the treatment procedure itself?
0% of it... _____ ...100% of it
6. How confident are you that you will no longer be a nail-biter at the end of treatment?
completely... _____ ...not at all

Name _____

Group # _____

