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FULL-LENGTH REPORT

Evaluating the role of Approach-Avoidance Training on action-tendencies in individuals with skin-picking disorder: A preliminary randomized experiment

ABEL S. MATHEW, MADELINE A. RECH and HAN-JOO LEE*

Department of Psychology, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin, USA

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ABSTRACT

Background and aims: Pathological skin-picking (PSP) or excoriation disorder is a destructive behavior that affects 1-2% of the general population. The purpose of this pilot study was to evaluate the effect of a computerized behavior modification task on action-tendencies (i.e., approach or avoidance) in adults with PSP. We aimed to modify these action-tendencies by having participants with PSP complete the Approach-Avoidance Training (AAT) task, using a joystick to simulate an approach (=pull) or avoidance (=push) response. *Method:* Forty-five participants diagnosed with PSP were randomized to one of three training conditions: (1) Avoidance Training (AvT; n = 15), (2) Approach Training (ApT; n = 15), or (3) Placebo Training (PT; n = 15). We hypothesized that after training, those in the AvT would have the greatest reduction in behavioral approach (i.e., their overall reaction time [RT] to approach pictures of irregular skin stimuli). *Results:* Results of the pre-training assessment task revealed a positive correlation between behavioral approach to irregular skin stimuli and skin-picking severity as assessed by the Skin Picking Scale-Revised (SPS-R). After training, a *lower* behavioral approach and urges to pick were found in the AvT and PT groups, while those in the ApT reported higher behavioral approach and urges to pick. At two-week follow-up, no significant changes on the SPS-R were reported between groups. *Discussion:* Our preliminary data suggest that the AAT is a promising avenue of research to develop as a cognitive intervention to address an excessive behavioral approach tendency that characterizes skin-picking problems.

KEYWORDS

skin-picking, approach-avoidance training, action tendencies, cognitive bias modification, body-focused repetitive behaviors

INTRODUCTION

Skin picking (SP) disorder is a body-focused repetitive behavior (BFRB) that affects 1–2% of the population (Odlaug & Grant, 2008). To meet DSM-5 diagnostic criteria for SP disorder one must (a) engage in recurrent SP, resulting in skin lesions (b) report repeated attempts to decrease or stop SP (c) have clinically significant distress or functional impairment due to SP and (d) the SP must not be attributed to another medical/dermatological condition or mental health disorder (American Psychiatric Association, 2013). While SP may often be viewed as a harmless behavioral habit, repetitive picking can produce psychosocial impairment and severe medical consequences such as open sores, wounds, and infections (Grant et al., 2012; Flessner & Woods, 2006). Individuals with SP may also feel extreme anxiety or tension before picking, and receive gratification after completion, attenuating their anxiety levels (Diefenbach, Tolin, Meunier & Worhunsky, 2008; Swedo & Leonard, 1992).

While little is known about the etiology of SP, researchers have classified the disorder as an Obsessive-Compulsive Related Disorder (OCRD; APA, 2013) due to the motor driven and

*Corresponding author.
E-mail: leehj@uwm.edu

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compulsive nature of the behavior (Stein, Chamberlain & Fineberg, 2006). However, the literature has acknowledged the heterogeneity of SP (Odlaug, Chamberlain & Grant, 2010), especially due to its diagnostic obscurity, which has led to disagreements about its classification (Abramowitz & Jacoby, 2015). Indeed, BFRBs have previously been considered an impulse control disorder (DSM-IV), and currently, as an OCRD (DSM-5). As such, it is important to examine the nature of SP from other relevant theoretical frameworks to grasp the comprehensive picture of the condition. To supplement the current DSM-5 view on SP as an OCRD, one promising conceptualization that has garnered increasing attention in the literature is the behavioral addiction model. Research has shown that SP and hair pulling share substantial clinical features with other behavioral addictions (Grant, Potenza, Weinstein & Gorelick, 2010; Oliveirra et al., 2019), which include (a) repetitive/compulsive engagement in the behavior despite clearly adverse consequences, (b) diminished control over the problematic behavior, (c) appetitive urges prior to engagement in the problematic behavior, and (d) pleasant sensations during the picking behavior (Odlaug & Grant, 2008). In addition, "compulsive wanting," a behavioral addictive feature associated with reward seeking, was found to significantly predict an increase in the frequency of SP urges (Snorrason, Olafsson, Houghton, Woods & Lee, 2015). Moreover, a study showed that one-fourth of patients with BFRBs had a family history of substance addiction, which suggests a close linkage between BFRBs and behavioral addiction problems (Redden, Leppink & Grant, 2016). Therefore, we believe that it is highly useful to evaluate the nature of SP from a behavioral addiction perspective. This line of research may lead to an effective treatment that targets another underlying process of SP.

Behavioral addictions involve motivational orientations to either approach (decrease distance) or avoid (increase distance) stimuli within one's environment (Solarz, 1960). These individuals often report an inability to control the urge to engage in picking behavior (Odlaug, Chamberlain & Grant, 2010; Strack & Deutsch, 2004). These action-tendencies may occur cognitively (implicitly) and/or behaviorally (explicitly). Additionally, SP often occurs automatically or unconsciously (Arnold et al., 1998; Walther, Flessner, Conelea & Woods, 2009). Thus, individuals with SP may be more likely to approach than avoid salient irregular skin stimuli, which may resemble the pattern of their SP behavior. As such, the employment of computerized trainings to modify action-tendencies (i.e., automatic approach or avoidance behaviors) may be a promising avenue towards understanding the mechanisms of SP.

The Approach Avoidance Assessment was designed to identify an individual's underlying approach/avoidance tendencies through the difference in RTs between approach or avoidance action tendencies (Heuer, Rinck & Becker, 2007; Klein, Becker & Rinck, 2011; Rinck & Becker, 2007). The task employs a game-like technique where the participant pulls (=approach) or pushes (=avoid) a joystick in response to target stimuli. If the reaction time (RT) to approach is quicker than to avoid, it indicates an overall approach action-tendency (Fig. 1). Researchers have adapted this paradigm as a potential intervention tool for various behavioral problems (i.e., Approach-Avoidance Training: AAT), by systematically adjusting the task demands to modify the underlying (maladaptive) action tendencies (Wiers, Eberl, Rinck, Becker & Lindenmeyer, 2011; Wittekind, Feist, Schneider, Moritz & Fritzsche, 2015). However, the AAT has yet to be investigated as an intervention tool in SP.

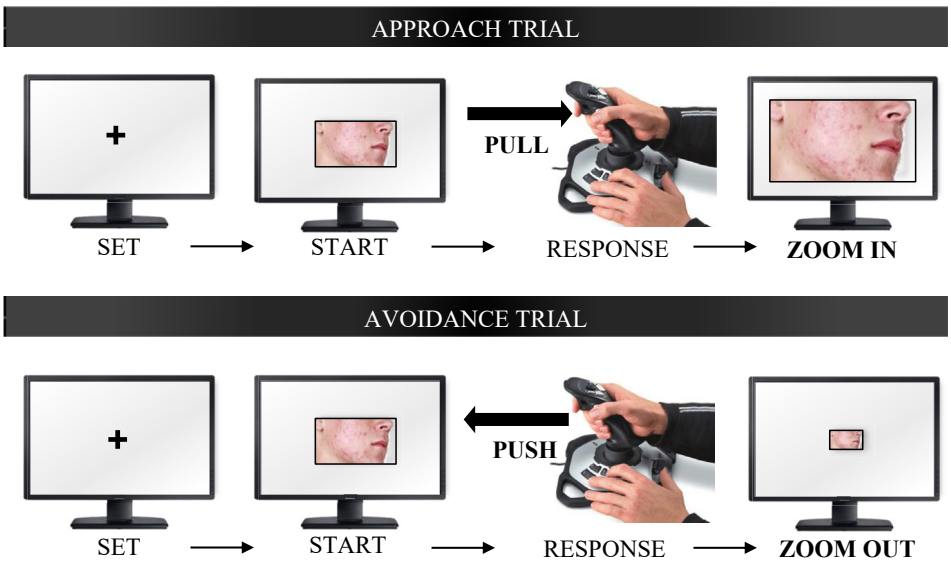

Fig. 1. Illustration of the AAT task.
Note. AAT = Approach Avoidance Training. Pulling the joystick simulates an approach response with a zoom in effect, while pushing the joystick simulates an avoidance response with a zoom out effect

The AAT addiction literature has documented the presence of an approach bias toward salient stimuli for those who engage in cannabis use (Cousijn, Goudriaan & Wiers, 2011), alcohol use (Wiers, Rinck, Dictus & Van den Wildenberg, 2009), cigarette smoking (Machulska, Zlomuzica, Adolph, Rinck & Margraf, 2015) and high-risk gambling (Boffo et al., 2018). Cousijn et al. (2011) showed that approach bias towards cannabis stimuli predicted increased cannabis use at 6-month follow up. In addition, Boffo et al. (2018) found that gambling approach bias predicted both past and future gambling persistence over time. As a training tool, the AAT has shown promising results for other addictions like alcohol use and cigarette smoking (Heuer et al., 2007; Klein et al., 2011; Wiers et al., 2011; Wittekind et al., 2015). Wiers, Rinck, Kordts, Houben & Strack (2010) showed that problematic alcohol users, who received the AAT-intervention, showed strong avoidance from alcohol at post-training (Wiers et al., 2010). Similarly, Wittekind et al., 2015 implemented an intervention for smoking cessation, showing a reduction in cigarette consumption for those who underwent AAT (Wittekind et al., 2015).

Given the behavioral addiction account, we believe that individuals with SP will exhibit a pathological approach toward visual irregularities of skin, which may trigger their urges to pick and subsequently lead to the feelings of gratification/relief through picking behavior. Reducing negative affect may contribute to the development of maladaptive, addictive picking behavior. Thus, it seems reasonable to examine whether the AAT geared toward decreasing approach in response to irregular skin pictures can show a therapeutic signal in individuals with SP.

Given the infancy of this line of investigation, there is a lack of empirical data to guide us in determining which skin stimuli are appropriate to use for the AAT (e.g., pictures of healthy skin, irregular skin, or severely damaged skin). We used irregular skin as the primary stimulus for a few important reasons: (1) irregular skin is thought to trigger skin-picking urges and make the approach tendency pronounced, thereby creating room for corrective training procedures (2) damaged skin may cause avoidance due to its saliently aversive nature, thereby making it difficult to assess the more naturalistic action-tendencies in response to skin materials. Therefore, we decided to use irregular skin as the target stimuli.

The purpose of this study was to assess and modify action-tendencies in an analogue sample of individuals who endorsed SP symptoms. First, we hypothesized that individuals with SP would show approach tendencies to pictures of irregular skin. Second, we hypothesized that greater approach tendencies would correlate with greater SP symptoms. The attention bias literature has shown that individuals with behavioral addictions fluctuate toward and away from appetitive stimuli over time (Zvielli, Bernstein & Koster, 2015). Thus, our study design consisted of three different training conditions: a) Approach Training (ApT; i.e., to increase approach tendencies toward irregular skin), b) Avoidance Training (AvT; i.e., to decrease approach tendencies toward irregular skin), and c) Placebo Training (PT; i.e., equal training of approach and avoidance with irregular skin). After training, we predicted that those in the AvT would decrease their approach tendencies to skin stimuli, those in the ApT would increase their approach tendencies, and those in the PT would show no change in approach/avoidance. We expected the same pattern of results in terms of urges to pick on a behavior assessment task and after two-week follow-up.

METHOD

Participants

Forty-five individuals with SP were recruited from a Midwestern university in exchange for compensation and/or course credit. Inclusion criteria were as follows: (1) moderate symptoms of skin-picking (i.e., Skin Picking Severity Scale (SPS) score of ≥7 (Keuthen et al., 2001; Snorrason, Belleau & Woods, 2012), (2) ages 18–60, and (3) fluent English speakers. Exclusion criteria were as follows: (1) visual impairment that could not be adjusted and would prevent one from clearly recognizing words and pictures on a computer screen including color blindness, (2) positive diagnosis of bipolar disorder, psychotic disorder, or current diagnosis of substance use disorder (moderate to severe), and (3) SP was better explained by a dermatological or medical condition (e.g., eczema, psoriasis). Participants were recruited through the university's campus research portal, research flyers, newspaper outlets, and other related studies involving individuals with SP. A two-part screening measure was required before inclusion in the main study including (1) questionnaires to determine full eligibility before being invited to the main study and (2) a phone-screen to determine eligibility using SP criteria from the DSM-5.

The mean age of participants ($N = 45$) was 22.29 years ($SD = 4.37$) and participants were predominately female (91.1%; $n = 41$). There were a variety of races reported: Asian (8.90%; $n = 4$), Black/African American (6.70%; $n = 3$), and White (75.60%; $n = 34$). In terms of ethnicity, individuals from Hispanic/Latino backgrounds represented 8.90% ($n = 4$) of our sample (Table 1).

Self-report measures

Skin picking severity scale (SPS-R). The SPS-R is an 8-item severity scale assessing impairment and symptom severity (Snorrason et al., 2012). Each item is rated on a 0 (none) to 4 (extreme) scale with a total score ranging from 0 to 32. The total score designates overall severity, and a sum higher than 7 represents clinical levels of skin-picking (Keuthen et al., 2001). In skin picking populations, the SPS-R has a robust factor structure, high internal consistency, and good convergent and discriminant validity (Snorrason et al., 2012). The measure showed good internal consistency in our sample of 0.86.

Depression, anxiety and stress scale (DASS-21). The DASS-21 is a 21-item self-report instrument designed to measure the three related negative emotional states of depression,

Table 1. Basic demographic and clinical characteristics

	AvT (n = 15) Percentage (n)	ApT (n = 15) Percentage (n)	PT (n = 15) Percentage (n)	Chi Square Test	*p*-value
Gender					
Male	13.30% (n = 2),	13.30% (n = 2),	0% (n = 0)	$X^2(2, N = 45)$	0.334
Female	86.70% (n = 13)	86.70% (n = 13)	100% (n = 15)	= 2.20	
Race					
Asian	6.70% (n = 1)	13.30% (n = 2)	6.70% (n = 1)	$X^2(4, N = 41)$	0.693
Black/African American	0% (n = 0)	13.30% (n = 2)	6.70% (n = 1)	= 2.23	
White	73.30% (n = 11)	73.30% (n = 11)	80.00% (n = 12)		
Ethnicity					
Hispanic or Latino	20.00% (n = 3)	0% (n = 0)	6.70% (n = 1)	$X^2(2, N = 45)$	0.146
Not Hispanic or Latino	80.00% (n = 12)	100.0% (n = 15)	93.30% (n = 14)	= 3.84	
	AvT (n = 15) Mean (*SD*)	ApT (n = 15) Mean (*SD*)	PT (n = 15) Mean (*SD*)	*F*-test	*p*-value
Age	23.33 (5.39)	21.40 (2.82)	22.13 (4.56)	*F* (2,42) = 0.740	0.483
Questionnaires					
SPS-R Total	11.73 (4.61)	12.20 (4.78)	12.20 (6.09)	F (2,42) = 0.040	0.961
SPS-R Frequency	7.47 (2.72)	8.47 (3.16)	7.33 (2.79)	F (2,42) = 0.685	0.51
SPS-R Impairment	4.27 (2.40)	3.73 (2.52)	4.87 (3.62)	F (2,42) = 0.573	0.568
DASS-21 Total	41.87 (22.01)	43.33 (32.18)	44.93 (31.92)	F (2,42) = 0.042	0.959
Depression	9.87 (7.54)	16.53 (14.80)	14.40 (13.34)	F (2,.42) = 1.149	0.327
Anxiety	14.67 (11.23)	10.53 (10.78)	14.80 (11.61)	F (2,42) = 0.702	0.501
Stress	17.33 (5.79)	16.27 (10.79)	15.73 (10.85)	F (2,42) = 0.112	0.895
SPIS	10.80 (11.43)	14.53 (10.59)	13.80 (14.22)	F (2,42) = 0.396	0.676

Note. AvT = Avoidance Training; ApT = Approach Training; PT = Placebo Training; SD = Standard deviation; *p* = probability value. SPS-R = Skin Picking Scale – Revised; DASS-21 = Depression, Anxiety, and Stress Scale; SPIS = Skin Picking Impact Scale.

anxiety, and tension/stress (Lovibond & Lovibond, 1995). Items are rated from 0 (did not apply to me at all) to 3 (applied me very much or most of the time) in which higher scores indicate greater symptom severity. The DASS-21 has good internal consistency and convergent validity in clinical and nonclinical samples (Antony, Bieling, Cox, Enns & Swinson, 1998). The measure demonstrated excellent internal consistency in our sample of 0.94.

Diagnostic interview

Mini international neuropsychiatric interview (MINI 6.0). The MINI is a brief diagnostic structured interview for the major Axis I psychiatric disorders. The interview assessed whether individuals met exclusion criteria. The OCRD module was adapted for assessing SP symptoms. Interviews were conducted by trained research assistants or the first author. All interviews were recorded and reviewed in staff meetings to confirm diagnostic results.

Behavior assessment task (BAT)

Participants had three minutes to feel their face, arms, legs, or other areas that did not feel "just right". Without picking, participants described urges to pick as they came across different areas. The experimenter recorded urges on a scale of 0 (no urges to pick) to 100 (high urges to pick). This procedure was repeated for each area the participant reported urges to pick. The task was completed before and after the AAT. On average, participants picked from approximately three sites before (M = 2.35) and after (M = 2.20) training. The peak urge at each assessment point (i.e., peak BAT score) was used to determine urges to pick at post-training.

Simple reaction time task (SRT)

The SRT task assessed pure RT using a joystick. Participants were instructed to push a joystick in response to an arrow on the screen pointing upwards or pull a joystick in response to an arrow pointing downwards. The task evaluated whether visual-motor reaction speed was equivalent between groups.

Approach avoidance assessment

All eligible participants completed the Approach Avoidance Assessment before and after training to determine the participant's approach or avoidance to pictures of irregular skin. Participants looked at a computer screen and pushed/pulled a joystick at a 30-degree angle according to the format the pictures were assigned (i.e., landscape or portrait). The assessment task contained 96 trials: 4 pictures x 2 picture types (i.e., wood or irregular skin) x 2 formats (i.e., landscape or portrait) x 6 repetitions. The presentation of wood and irregular skin pictures was equal between formats so that no manipulation/training was done during the assessment. To further emphasize approach/avoidance, the assessment and training employed a zooming effect (Rinck & Becker, 2007). Specifically, pushing the joystick away causes the picture on the screen to shrink

(=avoidance), while pulling the joystick towards oneself causes the picture to expand (=approach). The Approach Avoidance Assessment-Behavioral Approach Index was calculated by subtracting the approach RT from the avoid RT (i.e., avoid RT – approach RT) for each participant. Therefore, positive scores indicate behavioral *approach* (i.e., faster RT to approach stimuli), while negative scores indicate behavioral *avoidance* (i.e., faster RT to avoid stimuli).

Skin-picking approach avoidance training (AAT)

Participants were randomly assigned to the AvT (n = 15), ApT (n = 15), or PT (n = 15) condition. Each 20-min training block contained 384 trials: 8 pictures x 2 picture types (i.e., wood or irregular skin) x 2 border colors (i.e., blue or yellow) x 12 repetitions. The length of training is similar to a typical training session in other CBM studies that implemented the AAT (Sharbanee et al., 2014; Becker, Jostmann, Wiers & Holland, 2015). Our participants completed *three* training blocks (corresponding to a three-session dose of training), which was designed to augment the potency of the training effects. These trainings are described below (Table 2 and 3).

Table 3. Doctoral level graduate student ratings of image

	Mean	Minimum	Maximum
Skin Pictures	53.98	30.38	74.11

Note. Pictures were rated along the following dimensions using a 0 - 100 sliding scale where 0 represented "healthy skin", 50 represented "irregular skin" (our target), and 100 represented "severely damaged skin". The following include the average, minimum, and maximum score across the photos. Photos that were rated near 50 were considered irregular skin.

Avoidance training (AvT). Participants were instructed to push/pull the joystick based on a rule assigned to the color of the border (i.e., blue or yellow) with each picture (i.e. irregular skin or wood). Pictures of irregular skin were always avoided (i.e. 100% avoidance), and pictures of wood were approached and avoided equivalently (i.e. 50% approach and 50% avoidance). Thus, participants were trained to avoid skin. The wood stimuli were used as a control stimulus.

Approach training (ApT). Those in the ApT completed training similar to the AvT with the following exception: Pictures of irregular skin were always approached (i.e. 100% approach). Thus, participants were trained to approach skin.

Table 2. Descriptive statistics in outcome measures, and their differences across groups

		AvT (n = 14) Mean (SD)	ApT(n = 15) Mean (SD)	PT (n = 15) Mean (SD)	[a]*F* Test *p*, η_p^2
A. Simple Reaction Time (SRT)					
Overall Complete		633.36 (70.79)	600.93 (75.95)	616.21 (134.59)	F (2,42) = 0.410, p = 0.666, η_p^2 = 0.020
Pull Complete		619.93 (60.68)	595.07 (69.92)	606.44 (140.20)	F (2,42) = 0.247, p = 0.782 η_p^2 = 0.012
Push Complete		646.77 (85.26)	606.73 (87.59)	625.85 (129.86)	F (2,42) = 0.567, p = 0.571 η_p^2 = 0.030
B. AAA Task Outcomes for Skin Pictures (Pre/Post-Training)					
Approach Complete	Pre	829.43 (202.83)	892.66 (231.66)	841.25 (299.49)	F (2,37) = 7.06, p = 0.003, η_p^2 = 0.28
	Post	761.05 (137.39)	673.93 (95.02)	739.31 (212.83)	
Avoid Complete	Pre	884.47 (258.20)	943.31 (211.38)	963.97 (440.05)	F (2,37) = 4.02, p = 0.03, η_p^2 = 0.18
	Post	781.85 (165.73)	769.87 (101.71)	726.34 (173.95)	
Overall Complete	Pre	55.04 (82.65)	50.66 (73.38)	122.72 (149.82)	F (2,37) = 5.75, p = 0.007, η_p^2 = 0.24
	Post	20.81 (111.22)	95.94 (42.63)	-12.98 (60.57)	
C. BAT Urge Outcomes (Pre/Post-Training)					
Pre		46.37 (30.76)	40.91 (31.51)	36.30 (31.61)	F (2,38) = 4.24, p = 0.022, η_p^2 = 0.18
Post		34.39 (27.46)	42.80 (29.86)	26.29 (25.41)	
D. SPS-R Outcomes (Pre-Training and Follow-Up)					
Total					
Pre		11.73 (4.61)	11.62 (4.82)	12.43 (6.25)	F (2,35) = 1.19, p = 0.32, η_p^2 = 0.06
FU		11.80 (4.75)	9.92 (4.70)	10.93 (6.86)	
Impairment					
Pre		4.27 (2.40)	3.46 (2.54)	5.07 (3.67)	F (2,35) = 1.36, p = 0.27, η_p^2 = 0.07
FU		4.67 (3.11)	3.54 (2.40)	4.29 (3.67)	
Frequency					
Pre		7.47 (2.72)	8.15 (3.29)	7.36 (2.90)	F (2,35) = 3.67, p = 0.68, η_p^2 = 0.51
FU		7.13 (2.17)	6.38 (2.81)	6.64 (3.48)	

Note. AvT = Avoidance Training; ApT = Approach Training; PT = Placebo Training; AAA = Approach Avoidance Assessment; Complete = Complete values (i.e. the length of time to finish the action; averaged for all approach and avoidance trials per participant); BAT = Behavior Assessment Task; SPS-R = Skin Picking Scale-Revised; Pre = Pre-training assessment; Post = Post-training assessment; FU = Two-week follow-up after study.

Placebo training (PT). Those in the PT had a similar experience to those in the AvT and ApT trainings, except the rule for pushing or pulling irregular skin was equally presented among the blue and green-bordered pictures (i.e. 50% approach and 50% avoidance for irregular skin stimuli). We expected approach/avoidance of skin to remain unchanged in these participants.

Two-week follow-up

All participants were sent an email with a link to complete follow-up questionnaires (i.e., SPS-R, DASS-21), to determine any changes in SP and other symptoms.

Procedure

After completing a screening questionnaire (i.e., the SPS-R), prospective participants completed a phone screening to determine if they exhibited skin picking symptoms. Eligible participants were invited to the main study and completed the battery of questionnaires aforementioned. Next, assessment tasks were administered in the following order: BAT, SRT, and Approach Avoidance Assessment. A random number generator was used to assign participants to AvT, ApT, or PT. Participants completed their assigned training three times. After the AAT, participants repeated the BAT and Approach Avoidance Assessment. Participants responded to the follow-up questionnaires over the Internet after approximately two weeks (Fig. 2). The current study was reviewed and approved by the Institutional Review Board of the University of Wisconsin-Milwaukee Human Research Protection Program (IRB #18.151).

Data analysis

The Approach Avoidance Assessment and BAT scores were evaluated separately using one-way ANCOVAs with the post-training assessment as the dependent variable and the pre-training assessment as the covariate. We also used indices of general emotional distress as additional covariates to partial out their influence. Depression and anxiety are highly comorbid with and associate with greater SP severity (Neziroglu, Rabinowitz, Breytman & Jacofsky, 2008; Grant et al., 2012). Additionally, significant stress can act as a trigger that may precipitate SP episodes (Neziroglu et al., 2008; American Psychiatric Association, 2013). Therefore, pre-training assessment and emotional distress variables were added as covariates. To correct for Type 1 error inflation, the Dunn-Sidak correction test was used as a post-hoc analysis.

For our primary analytic approach based on ANCOVAs, we conducted a power analysis with G-Power. Setting the effect size of $f = 0.5$, alpha of 0.05, power of 0.8, and numerator df of 2, with the inclusion of 4 covariates (e.g., pre-training scores, depression, anxiety, and stress variables), the required sample size was 14 per group to achieve a power of 0.8. Thus, the current pilot study was sufficiently powered (N = 45) to detect a large-sized effect but was underpowered to detect a small to medium effect. It should be noted that pilot studies commonly focus on feasibility and acceptability of the study protocol (rather than seeking statistical significance) for a subsequent, larger study (Leon, Davis & Kraemer, 2011; Moore, Carter, Nietert & Stewart, 2011).

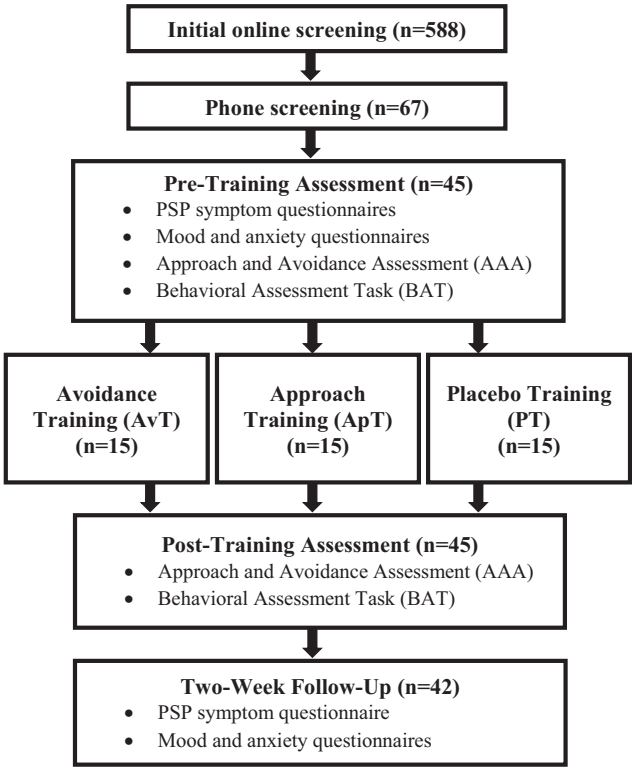

Fig. 2. Complete study activities flow chart.
Note. PSP = Pathological Skin-picking; AAA = Approach Avoidance Assessment; BAT = Behavior Assessment Task; PT = Placebo Training; ApT = Approach Training; AvT = Avoidance Training. Of the initial 588 participants, individuals were excluded after the initial online screening if they did not report a 7 or greater on the SPS-R. Of the remaining 67 participants, individuals were excluded after the phone screening if they did not indicate significant impairment based on the MINI 6.0. Obsessive-Compulsive and Related Disorder (OCRD) module (n = 17), if they were no longer interested in participating (n = 2), or if they were a no-show (n = 3). As a result, 45 individuals participated in the main study. Of the 45. individuals, three (i.e., 2 from the ApT and 1 from PT) did not complete the follow-up survey. Thus, the two-week follow-up was completed by 42 individuals

Ethics statement

The current study was reviewed and approved by the Institutional Review Board of the University of Wisconsin-Milwaukee (IRB#18.151). Participants underwent an informed consent process before completing the study.

RESULTS

Demographic and baseline variables

There were no significant group differences in age, F (2,42) = 0.74, $p = 0.48$, or gender, χ^2 ($N = 45$) = 2.20, $p = 0.33$

(Table 1). No between-group differences were observed on pre-training measures, including the DASS-21 (Table 1), SRT (Table 2A), Approach Avoidance Assessment (Table 2B), BAT (Table 2C), or SPS-R (Table 2D). Of 45 participants, 42 completed all study procedures with no missing data. Three participants (i.e., one from each condition), completed all procedures except the follow-up assessment.

Behavior addiction and action-tendencies in SP

A paired sample t-test was used to compare approach and avoidance orientations to skin stimuli. Results revealed faster approach to pictures of skin stimuli than avoidance, $t(44) = -4.58$, $p < 0.001$, $d = 0.68$. In contrast, participants did not show significant differences in approach or avoidance to wood stimuli, $t(44) = -1.92$, $p = 0.062$, $d = 0.29$. A comparison between skin and wood stimuli revealed a faster approach toward skin stimuli than wood stimuli, $t(44) = 2.66$, $p = 0.01$, $d = 0.40$.

Relationship between behavioral approach and SP severity. We observed a positive relationship between SP symptoms and behavioral approach towards irregular skin, $r(45) = 0.42$, $p = 0.004$. In contrast, behavioral approach toward wood stimuli was not correlated with SP symptoms $r(45) = 0.10$, $p = 0.52$.

Action-tendencies on the approach avoidance assessment. A one-way ANCOVA revealed a significant group difference in the Approach Avoidance Assessment-Behavioral Approach Index at post-training, even after controlling for pre-training Approach Avoidance Assessment-Behavioral Approach Index, as well as anxiety, depression, and stress variables, $F(2,37) = 5.75$, $p = 0.007$, $\eta_p^2 = 0.24$, (Fig. 3; Table 2B). Post hoc comparisons using the Dunn-Sidak correction indicated that the Approach Avoidance Assessment-Behavioral Approach Index of the AvT ($M = -9.20$) and PT ($M = 7.89$) conditions at post-training were significantly lower (=reduced approach toward skin pictures) than the ApT ($M = 81.93$) condition. However, the AvT and PT were not significantly different at post-training on the Approach Avoidance Assessment, $p > 0.05$.

BAT. A one-way ANCOVA revealed a significant difference in post-training peak BAT scores between groups after controlling for pre-training peak BAT scores, as well as anxiety, depression, and stress variables, $F(2,38) = 4.24$, $p = 0.022$, $\eta_p^2 = 0.18$ (Fig. 4; Table 2C). Post hoc comparisons using the Dunn-Sidak correction indicated that BAT scores in both the AvT ($M = 34.39$) and PT ($M = 26.29$) conditions at post-training were significantly lower (=reduced urges to skin pick) than the ApT ($M = 42.80$) condition. Similar to the Approach Avoidance Assessment at post-training, the AvT and PT were not significantly different at post-training on the BAT, $p > 0.05$.

Two-week follow-up

A one-way ANCOVA did not demonstrate a significant difference in SPS-R scores between groups at two-week follow-up after controlling for pre-training SPS-R scores, as well as anxiety, depression, and stress variables, $F(2,35) = 1.19$, $p = 0.32$, $\eta_p^2 = 0.06$ (Table 2D).

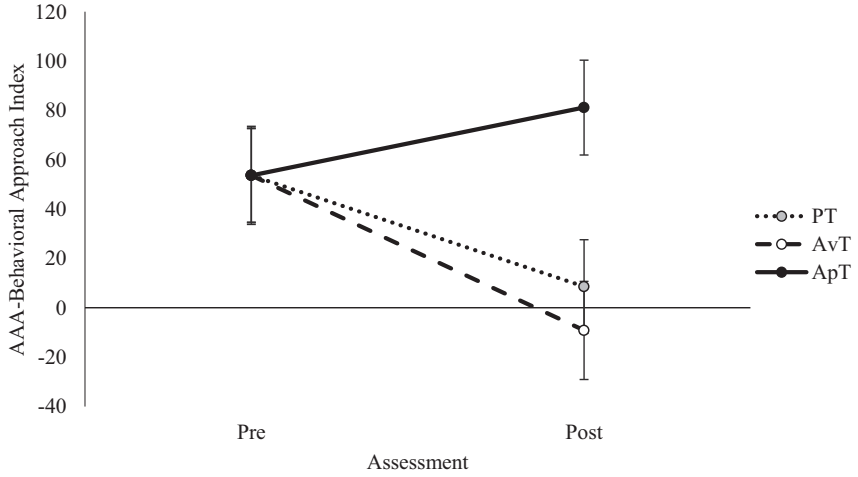

Fig. 3. Covariate-adjusted AAA-behavioral approach index.

Note. RT = Reaction time; PT = Placebo Training; AvT = Avoidance Training; ApT = Approach Training; AAA-Behavioral Approach Index = Approach Avoidance Assessment (AAA)-Behavior Approach Index: calculated by subtracting the approach RT from the avoid RT.

This figure depicts the difference in average post-training AAA-Behavior Approach scores between groups. Positive scores indicate behavioral tendencies (i.e., faster RT) to approach skin images. Negative scores indicate behavioral tendencies (i.e., faster RT) to avoid skin images. The error bars reflect standard error (SE). An covariate-adjusted AAA-Behavioral Approach Index Score ($M = 53.69$) was calculated across all groups prior to training. After training, the AAA-Behavioral Approach Index was calculated within the PT group ($M = 8.60$, $SE = 18.97$), AvT group ($M = -9.18$, $SE = 19.91$), and the ApT group ($M = 81.20$, $SE = 19.22$) by controlling for the pre-training AAA-Behavioral Approach Index, and depression, anxiety, and stress variables

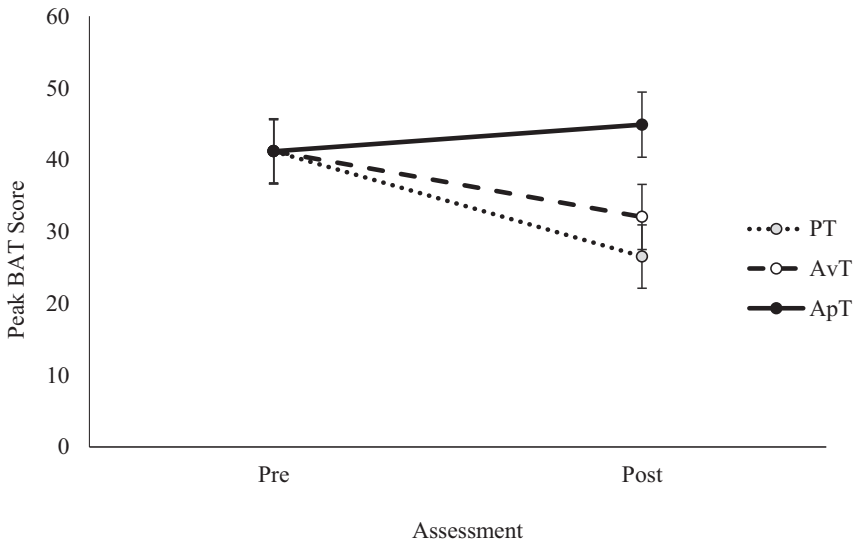

Fig. 4. Covariate-adjusted peak BAT scores.
Note. BAT Score = Behavior Assessment Task Score (assesses skin-picking urges on a 0-100 scale); PT = Placebo Training; AvT = Avoidance Training; ApT = Approach Training. This figure depicts the difference in average post-training peak BAT scores between groups. The error bars reflect standard error (SE). An covariate-adjusted peak BAT score (M = 41.19) was calculated across all groups prior to training. After training, the peak BAT Scores were calculated within the PT group (M = 26.53, SE = 4.41), AvT group (M = 32.05, SE = 4.54), and the ApT group (M = 44.89, SE = 4.54) by controlling for the pre-training peak BAT score, and depression, anxiety, and stress variables

DISCUSSION

SP is a debilitating condition, which may lead to psychosocial impairment, lesions, scars, or infections (American Psychiatric Association, 2013). SP can be conceptualized as a behavioral addiction based on the (1) urges, tension, or anxiety before picking, (2) pleasurable sensations of picking, (3) gratification after the act, and (4) compulsion to repeat skin-picking behavior (Odlaug et al., 2010). Based on the behavioral addiction model, this pilot study sought to evaluate whether the AAT could reduce dysfunctional approach action-tendencies in individuals with SP, and potentially reduce their skin-picking urges.

First, it should be noted that our Approach Avoidance Assessment data provide support for the hypothesized association between behavioral approach tendencies and SP. The current sample with SP displayed a behavioral approach rather than avoidance in response to pictures of irregular skin, which is consistent with the conceptualization of SP as a behavioral addiction (Odlaug & Grant, 2008). Notably, the pattern of behavioral approach was not observed for the neutral stimuli (i.e., wood). Additionally, the magnitude of behavioral approach to irregular skin was significantly correlated with the severity of skin-picking symptoms on the SPS-R. Neither a behavioral approach to wood, nor a correlation between wood and SPS-R were observed. These data are in line with the behavioral addiction model of SP, and support the current design of the AAT for SP.

We aimed to examine whether the AAT could modify action-tendencies in SP. As predicted the AvT (i.e., avoidance training) showed diminished behavioral approach at post-training, compared to the ApT (i.e., approach training). Contrary to expectation, the PT (i.e., a blend of approach and avoidance training) also showed a lower level of behavioral approach at post-training than the ApT, which suggests that the PT may also be beneficial for reducing the problematic behavioral approach tendency in SP. This may be due to the existence of mixed motivations/action-tendencies in SP. Indeed, it is quite common to observe ambivalent action-tendencies among individuals experiencing BFRBs because they experience gratification/relief from engaging in the behavior, but guilt or regret afterwards (Woods et al. 2006; Diefenbach, Tolin, Hannan, Crocetto & Worhunsky, 2005). It is conceivable that the PT helped these individuals improve their ability to flexibly regulate the fluctuation between approach and avoidance in response to skin materials, while contributing to reducing the overall approach action-tendency. A similar phenomenon has been observed in other anxiety-related disorders, like post-traumatic stress disorder (PTSD), where individuals fluctuate attention between threatening and neutral stimuli (Badura-Brack et al., 2015; Lazarov et al., 2019). As such, attention control training, similar to our PT training, was found to reduce the variability in the fluctuation between threatening and neutral stimuli more so than predominantly avoiding threat via attention bias modification in those with PTSD (Badura-Brack et al., 2015). Further research is needed to examine the mechanisms of change in the AvT and PT conditions for SP. Nevertheless, the pattern of training outcomes for the AvT vs. ApT is well aligned with our hypotheses.

Our findings on the Approach Avoidance Assessment, showing approach tendencies toward irregular skin, contrasted with the results of an Approach Avoidance Assessment study that reported *avoidance* tendencies in response

to irregular skin (Schuck, Keijsers, & Rinck, 2012). In their study, participants with SP and healthy controls were administered the Approach Avoidance Assessment task with a subset of participants with SP receiving cognitive behavior treatment afterwards. Compared to healthy controls, individuals with SP displayed a stronger *avoidance* of pictures of skin irregularities, which significantly correlated with higher skin picking severity. These findings are at odds with our data showing a behavioral *approach* tendency associated with SP symptom severity. Numerous methodological differences between the two studies might have contributed to the different patterns of action tendencies. Importantly, Shuck and colleagues included treatment seeking individuals with visible tissue damage, while we included an analogue sample who met criteria for SP symptoms. This clearly indicates the need for further research to better understand the pattern of action tendencies associated with SP. Particularly, the "irregularity" of skin materials needs to be systematically examined in the Approach Avoidance Assessment context, as it is possible that more aversive pictures of damaged skin may provoke increasingly stronger aversion, rather than the approaching tendency. Nevertheless, it should be noted that Schuck et al., 2012 found that stronger avoidance of pictures of skin irregularities on the Approach Avoidance Assessment was associated with *better* CBT treatment outcome for those who underwent CBT afterwards. This finding is well aligned with our findings and the behavioral addiction account of SP in that the lower level of behavioral approach was found to be a positive predictor of favorable therapeutic outcomes. Although they did not assess how their participants' action tendencies on the Approach Avoidance Assessment changed after CBT, these findings seem to provide indirect support for our proposed design of cognitive training aimed at reducing behavioral approach in line with the behavioral addiction account. Taken together, further research is needed to carefully understand the underlying pattern of action tendencies in SP, and the ideal task parameters of the Approach Avoidance Assessment to serve as a sensitive and accurate assessment tool.

Given the single-session training procedure for our preliminary experiment, we were unable to evaluate changes in SP symptoms using traditional skin-picking measures as an outcome index. Similar experimental investigations have utilized the BAT as a viable clinical outcome measure that has shown good psychometric properties and sensitivity to behavioral changes in psychopathology (Steketee, Chambless, Tran, Worden & Gillis, 1996; Klein et al., 2011). The BAT revealed that those in the ApT had significantly higher peak urges to pick at post-training compared to those in the PT and AvT. Similar to the results above, no significant differences between the PT and AvT group were found. The immediate effects of the training confirm our hypothesis that training individuals to approach/avoid skin stimuli not only changes their approach tendencies to irregular skin stimuli, but their urges to pick as well. Overall, the current AAT warrants further research as an effective training program to produce therapeutic change in SP.

We expected to see differences in SP symptoms at two-week follow-up using the SPS-R; however, no differences were observed across groups. The results contrast with significant changes in urges shown among the three groups. Several possible reasons may explain this. First, the lack of significant differences at two-week follow-up may be due to the suboptimal potency of the single-session training (despite having a dose comparable to three sessions combined in typical computerized cognitive training studies), which may have obscured potential differences across the training groups. Future studies need to expand the training dose (e.g., bi-weekly training sessions for four weeks), while examining the dose-response relationship of the AAT program. Second, the time window for evaluating the follow-up outcomes may not have been adequate to observe self-reported changes in SP symptoms. In other words, two weeks may not be enough to detect meaningful changes in symptom severity as a result of the training. Third, implicit changes in action-tendencies and urges may have occurred, but not sensitively captured by the self-report instruments. Thus, the changes may not be readily reflected in self-report measurements. Future studies may evaluate the BAT at follow-up to determine if changes in urges to pick were sustained after two weeks. If so, it may be that the BAT can act as a useful clinical outcome measure for determining improvement in SP symptoms.

Limitations and future directions

This study is not without limitations. First, despite individual variations between picking sites (e.g., arms, fingers, legs, forehead), our computerized assessment and training programs used a fixed set of skin pictures. Although we included pictures of a variety of body areas to increase their relevance for many individuals, the lack of a personally tailored assessment and training is a limitation. Future research may include AATs for specific areas, which are more relevant to the individual and may lead to better training response. Second, the methodological conceptualization of the action of pushing or pulling (i.e. forward, backward, or side-to-side) is important to consider for this training task (Eder & Rothermund, 2008). Research has shown no difference in RT between pushing and pulling actions but has purported that push is associated with avoidance and pull is associated with approach (Heuer et al., 2007; Klein et al., 2011). Therefore, asking participants (before beginning training) whether pushing means avoidance or approach to them, or whether it is more natural to push/pull in a forward, backward, or side-to-side motion may aid in achieving the intended result. Future research may counter-balance the push-pull direction to examine the potential effect between action tendencies and particular movements. Third, participants completed this study in a laboratory setting where they would not naturally experience urges to pick. Research has shown that individuals with BFRBs are more likely to engage in the BFRB in private settings away from others (Teng, Woods, Twohig & Marcks,

2002). While we attempted to provoke urges to pick through the BAT, our findings may not fully account for contextual differences where one typically acts on the behavior. Future research may examine whether conducting the training in a salient environment can improve its potency. Fourth, we recruited an analogue sample of individuals with a variety of SP symptoms. Our goal was to recruit individuals who endorsed the moderate to severe level of SP symptoms. Nevertheless, future studies need to replicate this study with a treatment-seeking clinical sample (i.e., severe SP symptoms) to examine the therapeutic effects of the AAT.

Overall, this single-session randomized experiment was intended to determine the feasibility of the AAT for future work in SP. We were able to determine that action tendencies are subject to experimental manipulation. Additionally, we were able to show lower or higher approach/avoidance tendencies in the intended direction using the AAT. Despite the unexpected findings from PT, the training still reduced approach tendencies toward skin in this group. Finally, we found that this procedure could be implemented in individuals who struggle with SP using the AAT and assessment tasks like the Approach Avoidance Assessment and BAT. Successful implementation of this line of research can potentially lead to an adjunctive treatment option and expanded to other impulse control disorders.

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REFERENCES

Abramowitz, J. S., & Jacoby, R. J. (2015). Obsessive-compulsive and related disorders: A critical review of the new diagnostic class. *Annual Review of Clinical Psychology*, *11*, 165–186. https://doi.org/10.1146/annurev-clinpsy-032813-153713.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub. https://doi.org/10.1007/springerreference_179660

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the depression anxiety stress scales in clinical groups and a community sample. *Psychological Assessment*, *10*(2), 176. https://doi.org/10.1037/1040-3590.10.2.176.

Arnold, L. M., Mcelroy, S. L., Mutasim, D. F., Dwight, M. M., Lamerson, C. L., & Morris, E. M. (1998). Characteristics of 34 adults with psychogenic excoriation. *The Journal of Clinical Psychiatry*, *59*(10), 509–514. https://doi.org/10.4088/jcp.v59n1003.

Badura-Brack, A. S., Naim, R., Ryan, T. J., Levy, O., Abend, R., Khanna, M. M., & Bar-Haim, Y. (2015). Effect of attention training on attention bias variability and PTSD symptoms: Randomized controlled trials in Israeli and U.S. combat veterans. *American Journal of Psychiatry*, *172*(12), 1233–1241. https://doi.org/10.1176/appi.ajp.2015.14121578.

Bechara, A (2005). Decision making, impulse control and loss of willpower to resist drugs: Aneurocognitive perspective. *Nature Neuroscience*, *8*, 1458–1463. https://doi.org/10.1038/nn1584.

Becker, D., Jostmann, N. B., Wiers, R. W., & Holland, R. W. (2015). Approach avoidance training in the eating domain: Testing the effectiveness across three single session studies. *Appetite*, *85*, 58–65. https://doi.org/10.1016/j.appet.2014.11.017.

Boffo, M., Smits, R., Salmon, J. P., Cowie, M. E., de Jong, D. T., Salemink, E., …. Wiers, R. W. (2018). Luck, come here! Automatic approach tendencies toward gambling cues in moderate-to high-risk gamblers. *Addiction*, *113*(2), 289–298. https://doi.org/10.1111/add.14071.

Cousijn, J., Goudriaan, A. E., & Wiers, R. W. (2011). Reaching out towards cannabis: Approach-bias in heavy cannabis users predicts changes in cannabis use. *Addiction*, *106*(9), 1667–1674. https://doi.org/10.1111/j.1360-0443.2011.03475.x.

Diefenbach, G. J., Tolin, D. F., Hannan, S., Crocetto, J., & Worhunsky, P. (2005). Trichotillomania: Impact on psychosocial functioning and quality of life. *Behaviour Research and Therapy*, *43*(7), 869–884. https://doi.org/10.1016/j.brat.2004.06.010.

Diefenbach, G. J., Tolin, D. F., Meunier, S., & Worhunsky, P. (2008). Emotion regulation and trichotillomania: A comparison of clinical and nonclinical hair pulling. *Journal of Behavior Therapy and Experimental Psychiatry*, *39*(1), 32–41. https://doi.org/10.1016/j.jbtep.2006.09.002.

Eder, A. B., & Rothermund, K. (2008). When do motor behaviors (mis)match affective stimuli? An evaluative coding view of approach and avoidance reactions. *Journal of Experimental Psychology: General*, *137*(2), 262–281. https://doi.org/10.1037/0096-3445.137.2.262.

Field, M., Eastwood, B., Bradley, B., & Mogg, K. (2006). Selective processing of cannabis cues in regular cannabis users. *Drug and Alcohol Dependence*, *85*, 75–82. https://doi.org/10.1016/j.drugalcdep.2006.03.018.

Flessner, C. A., & Woods, D. W. (2006). Phenomenological characteristics, social problems, and the economic impact associated with chronic skin-picking. *Behavior Modification*, *30*(6), 944–963. https://doi.org/10.1177/0145445506294083.

Grant, J. E., Odlaug, B. L., Chamberlain, S. R., Keuthen, N. J., Lochner, C., & Stein, D. J. (2012). Skin-picking disorder. *American Journal of Psychiatry*, *169*(11), 1143–1149. https://doi.org/10.1176/appi.ajp.2012.12040508.

Grant, J. E., Potenza, M. N., Weinstein, A., & Gorelick, D. A. (2010). Introduction to behavioral addictions. *The American Journal of Drug and Alcohol Abuse*, *36*(5), 233–241. https://doi.org/10.3109/00952990.2010.491884.

Heuer, K., Rinck, M., & Becker, E. S. (2007). Avoidance of emotional facial expressions in social anxiety: The approach–avoidance task. *Behaviour Research and Therapy*, *45*(12), 2990–3001. https://doi.org/10.1016/j.brat.2007.08.010.

Keuthen, N. J., Deckersbach, T., Wilhelm, S., Engelhard, I., Forker, A., Osullivan, R. L., & Baer, L. (2001). The skin-picking impact scale (SPIS): Scale development and psychometric analyses. *Psychosomatics*, *42*(5), 397–403. https://doi.org/10.1176/appi.psy.42.5.397.

Klein, A. M., Becker, E. S., & Rinck, M. (2011). Approach and avoidance tendencies in spider fearful children: The approach-avoidance task. *Journal of Child and Family Studies*, *20*, 224–231. https://doi.org/10.1007/s10826-010-9402-7.

Lazarov, A., Suarez-Jimenez, B., Abend, R., Naim, R., Shvil, E., Helpman, L., Neria, Y., & Neria, Y. (2019). Bias-contingent attention bias modification and attention control training in treatment of PTSD: A randomized control trial. *Psychological Medicine*, *49*(14), 2432–2440. https://doi.org/10.1017/s0033291718003367.

Leon, A. C., Davis, L. L., & Kraemer, H. C. (2011). The role and interpretation of pilot studies in clinical research. *Journal of Psychiatric Research*, *45*(5), 626–629. https://doi.org/10.1016/j.jpsychires.2010.10.008.

Lovibond, P., & Lovibond, S. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the beck depression and anxiety inventories. *Behaviour Research and Therapy*, *33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-u.

Machulska, A., Zlomuzica, A., Adolph, D., Rinck, M., & Margraf, J. (2015). "A cigarette a day keeps the goodies away": Smokers show automatic approach tendencies for smoking—but not for food-related stimuli. *PloS One*, *10*(2), e0116464. https://doi.org/10.1371/journal.pone.0116464.

Moore, C. G., Carter, R. E., Nietert, P. J., & Stewart, P. W. (2011). Recommendations for planning pilot studies in clinical and translational research. *Clinical and Translational Science*, *4*(5), 332–337. https://doi.org/10.1111/j.1752-8062.2011.00347.x.

Neziroglu, F., Rabinowitz, D., Breytman, A., & Jacofsky, M. (2008). Skin picking phenomenology and severity comparison. *The Primary Care Companion to The Journal of Clinical Psychiatry*, *10*(04), 306–312. https://doi.org10.4088/pcc.v10n0406.

Odlaug, B. L., Chamberlain, S. R., & Grant, J. E. (2010). Motor inhibition and cognitive flexibility in pathologic skin picking. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *34*(1), 208–211. https://doi.org/10.1016/j.pnpbp.2009.11.008.

Odlaug, B. L., & Grant, J. E. (2008). Clinical characteristics and medical complications of pathologic skin picking. *General Hospital Psychiatry*, *30*(1), 61–66. https://doi.org/10.1016/j.genhosppsych.2007.07.009.

Oliveirra, E. C. B., Fitzpatrick, C. L., Kim, H. S., Gulassa, D. C. R., Amaral, R. S., de Mattos Cristiana, N., & Tavares, H. (2019). Obsessive–compulsive or addiction? Categorical diagnostic analysis of excoriation disorder compared to obsessive-compulsive disorder and gambling disorder. *Psychiatry Research*, *281*, 112518. https://doi.org/10.1016/j.psychres.2019.112518.

Redden, S. A., Leppink, E. W., & Grant, J. E. (2016). Body focused repetitive behavior disorders: Significance of family history. *Comprehensive Psychiatry*, *66*, 187–192. https://doi.org/10.1016/j.comppsych.2016.02.003.

Rinck, M., & Becker, E. S. (2007). Approach and avoidance in fear of spiders. *Journal of Behavior Therapy and Experimental Psychiatry*, *38*(2), 105–120. https://doi.org/10.1016/j.jbtep.2006.10.001.

Schuck, K., Keijsers, G., & Rinck, M. (2012). Implicit processes in pathological skin picking: Responses to skin irregularities predict symptom severity and treatment susceptibility. *Journal of Behavior Therapy and Experimental Psychiatry*, *43*(1), 685–691. https://doi.org/10.1016/j.jbtep.2011.09.004.

Sharbanee, J. M., Hu, L., Stritzke, W. G., Wiers, R. W., Rinck, M., & MacLeod, C. (2014). The effect of approach/avoidance training on alcohol consumption is mediated by change in alcohol action tendency. *PloS One*, *9*(1). https://doi.org/10.1371/journal.pone.0085855.

Snorrason, I., Belleau, E. L., & Woods, D. W. (2012). How related are hair pulling disorder (trichotillomania) and skin picking disorder? A review of evidence for comorbidity, similarities and shared etiology. *Clinical Psychology Review*, *32*(7), 618–629. https://doi.org/10.1016/j.cpr.2012.05.008.

Snorrason, I., Olafsson, R. P., Houghton, D. C., Woods, D. W., & Lee, H. J. (2015). "Wanting"and "liking"skin picking: A validation of the skin picking reward scale. *Journal of Behavioral Addictions*, *4*(4), 250–260. https://doi.org/10.1556/2006.4.2015.033.

Solarz, A. K. (1960). Latency of instrumental responses as a function of compatibility with the meaning of eliciting verbal signs. *Journal of Experimental Psychology*, *59*(4), 239–245. https://doi.org/10.1037/h0047274.

Spruyt, A., De Houwer, J., Tibboel, H., Verschuere, B., Crombez, G., Verbanck, P., & Noël, X. (2013). On the predictive validity of automatically activated approach/avoidance tendencies in abstaining alcohol-dependent patients. *Drug and Alcohol Dependence*, *127*, 81–86. https://doi.org/10.1016/j.drugalcdep.2012.06.019.

Stein, D. J., Chamberlain, S. R., & Fineberg, N. (2006). An ABC model of habit disorders: Hair-pulling, skin-picking, and other stereotypic conditions. *CNS Spectrums*, *11*(11), 824–827. https://doi.org/10.1017/s1092852900014978.

Steketee, G., Chambless, D. L., Tran, G. Q., Worden, H., & Gillis, M. M. (1996). Behavioral avoidance test for obsessive compulsive disorder. *Behaviour Research and Therapy*, *34*(1), 73–83. https://doi.org/10.1016/0005-7967(95)00040-5.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, *8*(3), 220–247. https://doi.org/10.1207/s15327957pspr0803_1.

Swedo, S. E., & Leonard, H. L. (1992). Trichotillomania: An obsessive compulsive spectrum disorder? *Psychiatric Clinics*, *15*(4), 777–790. https://doi.org/10.1016/s0193-953x(18)30208-9.

Teng, E. J., Woods, D. W., Twohig, M. P., & Marcks, B. A. (2002). Body-focused repetitive behavior problems. *Behavior Modification*, *26*(3), 340–360. https://doi.org/10.1177/0145445502026003003.

Walther, M. R., Flessner, C. A., Conelea, C. A., & Woods, D. W. (2009). The milwaukee inventory for the dimensions of adult skin picking (MIDAS): Initial development and psychometric properties. *Journal of Behavior Therapy and Experimental*

Psychiatry, *40*(1), 127–135. https://doi.org/10.1016/j.jbtep.2008.07.002.

Wiers, R. W., Bartholow, B. D., Wildenberg, E. V., Thush, C., Engels, R. C., Sher, K. J., & Stacy, A. W. (2007). Automatic and controlled processes and the development of addictive behaviors in adolescents: A review and a model. *Pharmacology Biochemistry and Behavior*, *86*(2), 263–283. https://doi.org/10.1016/j.pbb.2006.09.021.

Wiers, R. W., Eberl, C., Rinck, M., Becker, E. S., & Lindenmeyer, J. (2011). Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. *Psychological Science*, *22*(4), 490–497. https://doi.org/10.1177/0956797611400615.

Wiers, R. W., Rinck, M., Dictus, M., & Van den Wildenberg, E. (2009). Relatively strong automatic appetitive action-tendencies in male carriers of the OPRM1 G-allele. *Genes, Brain and Behavior*, *8*(1), 101–106. https://doi.org/10.1111/j.1601-183x.2008.00454.x.

Wiers, R. W., Rinck, M., Kordts, R., Houben, K., & Strack, F. (2010). Retraining automatic action-tendencies to approach alcohol in hazardous drinkers. *Addiction*, *105*(2), 279–287. https://doi.org/10.1111/j.1360-0443.2009.02775.x.

Wiers, R. W., & Stacy, A. W. (2006). Implicit cognition and addiction. *Current Directions in Psychological Science*, *15*, 292–296. https://doi.org/10.1111/j.1467-8721.2006.00455.x.

Wittekind, C. E., Feist, A., Schneider, B. C., Moritz, S., & Fritzsche, A. (2015). The approach-avoidance task as an online intervention in cigarette smoking: A pilot study. *Journal of Behavior Therapy and Experimental Psychiatry*, *46*, 115–120. https://doi.org/10.1016/j.jbtep.2014.08.006.

Woods, D. W., Flessner, C., Franklin, M. E., Wetterneck, C. T., Walther, M. R., Anderson, E. R., & Cardona, D. (2006). Understanding and treating trichotillomania: What we know and what we don't know. *Psychiatric Clinics of North America*, *29*(2), 487–501. https://doi.org/10.1016/j.psc.2006.02.009.

Zvielli, A., Bernstein, A., & Koster, E. H. (2015). Temporal dynamics of attentional bias. *Clinical Psychological Science*, *3*(5), 772–788. https://doi.org/10.1177/2167702614551572.