

Reduction of Self-injury and Improvement of Coping Behavior during Dialectical Behaviour Therapy (DBT) of Patients with Borderline Personality Disorder

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ABSTRACT

The development of self-injury and coping was studied during dialectical behavior therapy of patients with a borderline personality disorder. Coping strategies and self-injury behaviors of 19 patients were assessed at pre-treatment, after six months of treatment, and at post-treatment. Apart from correlational analyses, Reliable Changes Indices (RCIs) were used to correct for the effects of chance, measurement error, and practice and to ensure that possible changes can be attributed to the effect of DBT, i.e., that a statistically significant change had occurred in the use of coping strategies and self-injury behaviors during DBT. At baseline, passive coping was used more frequently than active coping and little support was found for a relation between self-injury and coping. After treatment completion, fewer patients resorted to self-injury and passive coping and more active coping was used. Some indication was found for more changes in coping and self-injury in the first half year than in the second half year of treatment. Clinical implications are discussed.

Key words: self-injury, coping, borderline personality disorder, dialectical behavior therapy.

Intentional and direct physical self-injuries or alteration of body tissue without intent to die, is one of the most frequent and problematic behaviors among persons with a Borderline Personality Disorder (BPD). Self-injury damages the body often irrevocably and is associated with a high degree of morbidity, functional impairment, and other negative consequences for well-being (Linehan, 1993; Brown, Comtois, & Linehan, 2002).

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Although self-injury is maladaptive, the biosocial theory of Linehan (1993) states that in BPD, self-injury is used as a coping strategy: a behavioral or cognitive effort with short-term effectiveness in dealing with various external but mainly internal problems and demands (cf., Folkman & Lazarus, 1988). Self-injury seems to provide effective, short-term escape, relief and regulation of the large emotional burden the patient has to deal with. This burden is hypothesized to be caused by emotional vulnerability (Chapman, Gratz, & Brown, 2006) and an inability to adaptively up- and down-regulate emotions, produced by the combination of biological temperament (review: Lis, Greenfield, Henry, Guile, & Dougherty, 2007) and an invalidating rearing environment, as well as by their interaction and mutual influence over time (review: Brown, 1998; Harned, Banawan, & Lynch, 2006).

According to biosocial theory, these biological and environmental factors also lead to the use of other maladaptive coping skills, such as avoiding problems and emotions, and impede the development of more adaptive coping skills (Linehan, 1993, 1996). Furthermore, the positive consequences of maladaptive coping strategies, especially self-injury, not only contribute to the maintenance and reinforcement of these coping strategies (Chapman *et al.*, 2006; Linehan *et al.*, 2006), but also to the prevention of learning adaptive coping skills (Brown, 1998).

Although it is well-known that patients with BPD frequently use self-injury, less is known about the other coping strategies that Linehan refers to in her biosocial theory. The few available studies on coping and BPD show that BPD patients use more maladaptive coping strategies, that often incorporate passive coping. Passive coping refers to strategies that can provide short-term relief of the stressor or problem but cannot structurally change it (Lechner, van Dalen, & Bolman, 2006), such as avoiding emotions and problems (cf. Cheavens & Heiy, 2011), venting emotions, and using alcohol or drugs to deal with their emotions (Arntz, Klokman, & Sieswerda, 2005; Lobbestael, van Vreeswijk, & Arntz, 2008).

Patients with BPD infrequently use adaptive coping, such as active coping strategies focused on changing the source, the problematic character, or the stressful consequences of the problem (Arntz *et al.*, 2005; Lechner *et al.*, 2006; Lobbestael *et al.*, 2008). For example, BPD-patients have been shown to use few strategies that change the problem (active problem solving), change the problematic character of stressful situations, and/or change the cognitions causing the stress (Douglass, 2000; cf. Koenigsberg, Fan, Ochsner *et al.*, 2009; cf. Simor, Csóka, & Bódizs, 2010; Vollrath, Alnaes, & Torgersen, 1994), the latter being referred to as 'meaning-focused coping'. For social coping (Carver, Scheier, & Weintraub, 1989), findings are mixed. Some studies indicate that patients with BPD indeed use social resources to cope with problems (Chan, 2005; Douglass, 2000), while other studies indicate that they hardly use social coping (Kreudelbach, 1993; Vollrath *et al.*, 1994).

Linehan's biosocial theory implicates that self-injury and passive, maladaptive coping are related to each other because they are both caused by the same underlying mechanism of emotion dysregulation. In fact, self-injury is viewed as a passive form of coping as it does not adaptively change how to deal with emotions, but only helps to relieve or avoid these emotions in the short-term. Moreover, a negative relationship

between active coping and self-injury is suggested by the fact that the positive consequences of self-injury, which strengthen the use of this coping strategy, interfere with learning adaptive, active coping strategies. Knowledge of this relationship is important in order to get a better understanding of self-injury as a coping strategy and to possibly predict the use of self-injury by the use of other coping strategies and vice versa.

The few studies that have examined the relation between passive and active coping in BPD have found mixed results. For passive coping, it was shown that self-injury was positively related to emotional avoidance (Dubo, Zanarini, Lewis, & Williams, 1997) and not related to problem avoidance (Kehrer & Linehan, 1996). For active coping, no relation was found between self-injury and active problem solving (Douglass, 2000; Kehrer & Linehan, 1996). For meaning-focused coping in BPD, results were mixed. While some studies did not find any relation between self-injury and meaning-focused coping (Kehrer & Linehan, 1996), other studies found indirect evidence for a negative relation between self-injury and this coping strategy. They found that self-injury was negatively related to survival and coping beliefs, the latter being highly related to meaning-focused coping strategies (Rietdijk, Van den Bosch, Verheul, Koeter, & Van den Brink, 2001).

Since patients with BPD often get captured in a vicious circle of maladaptive coping and problem maintenance, the question arises whether it is possible to change BPD patients' coping behavior towards less maladaptive and more adaptive coping.

Although a person generally chooses from the same set of coping strategies over time, these strategies can change, for instance when a person encounters major life changes, goes into therapy, or follows training (Franken, Hendriks, Haffmans, & van der Meer, 2003). Both self-injury and other coping strategies are targeted in Linehan's Dialectical Behavior Therapy (DBT). This therapy, which is based on Linehan's biosocial theory (1993), is one of the most effective and widely utilized treatments for BPD. The ultimate goal of DBT is a full, meaningful life, which can be reached by creating a balance between acceptance and change. BPD patients are accepted as they are, which in turn teaches them to accept themselves. Within this context of acceptance, the therapist tries to help block or extinguish maladaptive behaviors and coping, and stimulates, teaches, and reinforces adaptive behaviors and coping. First of all, this goal is aimed at by showing that self-injury and passive coping are not useful but maladaptive strategies. Further, active, adaptive and skillful problem solving behaviors are trained to replace passive, helpless attempts of problem solving. Next to that, exposure-based strategies and mindfulness training are used to improve emotion regulation skills and reduce emotional vulnerability (e.g., Brown, 1998).

A growing body of research shows that DBT is an effective treatment for BPD, especially as a treatment of self-injury, causing a significant reduction in the frequency and severity of this behavior in BPD inpatients (Bohus *et al.*, 2000) and outpatients, compared to treatment as usual (Van den Bosch, Koeten, Stijnen, Verheul, & Van den Brink, 2005; Linehan *et al.*, 2006; Verheul *et al.*, 2003). In these studies, however, overall self-injury was investigated rather than specific self-injury behaviors (such as hitting or cutting oneself). In addition, a study comparing DBT to treatment by experts failed to demonstrate superiority of DBT in this respect (Linehan *et al.*, 2006).

To the best of the authors' knowledge, no prior research exists that directly addresses the effects of DBT on other coping strategies. There is only indirect evidence suggesting that DBT reduces passive coping and promotes active coping. It has been shown that BPD patients' survival and coping beliefs, which are highly related to meaning-focused coping such as reassuring thoughts (Rietdijk *et al.*, 2001), significantly improve during DBT (Low *et al.*, 2001). In addition, it has been shown that DBT adds to the reduction of emotion dysregulation (Bohus *et al.*, 2000; Koons *et al.*, 2001), which in turn could lead to a reduction of maladaptive, passive coping strategies and an increase of active coping. However, since these studies only found indirect evidence for the effects of DBT on coping strategies other than self-injury, more research is needed that directly addresses the development of coping during DBT. Moreover, although there is some indication that self-injury behaviors and coping behaviors are related, it is yet unknown whether changes in these behaviors are related to one another or even mutually reinforcing.

In the present study, we examined self-injury, a variety of coping strategies, the relation between self-injury and coping, and the development of these variables during DBT among patients with BPD. Based on Linehan's biosocial theory and available studies, we formulated the following hypotheses: (1) in comparison with the general population, patients with BPD use passive coping strategies more often than active coping strategies; (2) since there is some indication for a relation between coping strategies and self-injury, self-injury was expected to be positively related to the use of passive coping strategies (e.g., avoidance) and negatively related to the use of active coping strategies (e.g., meaning-focused coping); (3) BPD patients will develop and use more active, adaptive coping strategies, specifically meaning-focused coping, during DBT and use less passive, maladaptive coping strategies and self-injury behaviors. These changes are expected to parallel and relate to a reduction of self-injury.

METHOD

Participants

The sample of this study comprised of 19 (3 male and 16 female) outpatients aged 24-64 ($M = 45.74$ years, $SD = 10.67$) who were referred by a psychologist or psychiatrist to Dialectical Behavior Therapy treatment (DBT; Linehan, 1993; all participants in treatment agreed on participating in the study). All participants met the criteria for Borderline Personality Disorder according to the Dutch version of the Structured Clinical Interview for DSM-IV Axis I personality disorders (SCID-II; First, Spitzer, Gibbon, & Williams, 1994; Weertman, Arntz, & Kerkhofs, 2000) and were able to come to a signed, mutual agreement on the BPD treatment goals with their primary therapist. During one year, Dialectical Behavior Therapy (DBT; Linehan, 1993) was given in a Dutch outpatient mental health institution. Assessment-dropout was relatively high (42%); only 11 of the 19 participants completed assessment after a half year of DBT. Five of these 11 patients also completed measurement after one year, at post-treatment assessment. This relatively large attrition rate is mainly due to the large percentage of the patients in pre-

treatment who eventually did not start BPD treatment and the relatively large percentage of patients who dropped out of treatment (and consequently also our study). Attrition bias checks using t-tests to compare the samples at these two time frames revealed that these groups did not differ on their self-injury and coping behavior at pre-treatment.

Measures

Utrecht Coping List (UCL). Coping strategies were measured using the Utrecht Coping List (Schreurs, Van den Willige, Brosschot, Tellegen, & Graus, 1993), a 47-item Dutch self-report questionnaire that assesses coping on seven scales, with each scale representing one coping strategy: [1] active handling: actively changing the source of the problem, [2] palliative reaction: efforts at changing the feelings elicited by the problem by using a number of avoidance strategies, [3] avoidance: avoiding or resigning oneself to the problem or emotion, [4] seeking social support: seeking comfort, support and sympathy from others, [5] passive reactions: feeling helpless, pessimistic and overwhelmed by the problem, [6] expression of emotions: expressing one's negative feelings about the problem to others, [7] reassuring thoughts: engaging in self-comforting and reassuring thoughts which changes perception of the problem (meaning-focused coping). For each item, participants rated on a four-point Likert scale whether they hardly or never (1), sometimes (2), often (3), or very often (4) reacted to problems or unpleasant situations as was described. Item scores were used to calculate an average score on each coping strategy. Furthermore, these coping strategies were divided into passive and active coping strategies. In accordance with the literature and factor analysis by Schreurs and colleagues (1993) 'avoidance', 'passive reaction', and 'emotion expression' were used to compose an general passive coping score. 'Active handling', 'reassuring thoughts' and 'palliative reaction' were used to compose a general active coping score. 'Social coping' was related to both active and passive coping and therefore not used to calculate these composite scores. The UCL has sufficient reliability (Cronbach's alphas range from 0.64 to 0.82; Schreurs, Van de Willige, Tellegen & Brosschot, 1988), construct validity, and predictive validity (Schaufeli & Van Dierendonck, 1992).

Borderline Personality Disorder Severity Index (BPDSI). Self-injury behaviors were measured with the self-injury behavior items of the 'parasuicide' section of the Borderline Personality Disorder Severity Index (BPDSI; adapted instrument of Weaver & Clum, 1993), a reliable ($ICC = 0.97$; Cronbach's $\alpha = 0.93$). It is a semi-structured interview with excellent concurrent and construct validity that measures the frequency of borderline symptoms in the previous three-month period (Arntz, van den Hoorn, Verheul, Van den Bosch, & De Bie, 2003; Giesen-Bloo, Wachters, Schouten, & Arntz, 2010).

The BPDSI parasuicide section ($\alpha = 0.64$, $\mu = .95$ $SD = 1.18$) assesses various self-injury behaviors: [1] hit oneself, or hit or graze against something with your head, fist, knuckles, or other body parts; [2] scratch or pinch oneself; [3] bite oneself; [4] pull one's own hair; [5] cut or carve oneself; [6] burn oneself; [7] prick oneself with needles; [8] other self-injury behaviors, such as taking dangerous substances or inserting dangerous or sharp objects into body openings. Participants indicated for each item how often they had performed the self-injury behavior during the last three month-period: 0= never, 1= once, 2= twice, 3= three times, 4= 4 or 5 times, 5= 6 or 7 times, 6= 8 to 10 times, 7= 11 to 15 times (once a week), 8= several times a week but less than half of the week, 9= more than half of the week, 10= daily. Participants' answers were scored by the experimenter. Items were analysed both separately and combined to calculate a self-injury score for each participant.

Therapy

BPD patients assigned to Dialectical Behavior Therapy (DBT; Linehan, 1993) received one year of DBT treatment by experienced, social psychiatric nurses, psychologists and psychiatrists who had attended a ten-day seminar and practical training on DBT. DBT combined four elements: [1] weekly, in depth, individual cognitive-behavior psychotherapy sessions with the primary therapist (52 weeks). During these sessions, the therapist and patient worked on a hierarchy of general and personal treatment goals they agreed on in the pre-treatment phase (the latter consisting of minimally three, weekly sessions with the primary therapist). These goals mainly addressed therapy interference behavior, quality of life issues, and self-injury and suicidal behavior. The latter being daily recorded in a diary, and later discussed with the therapist. Patients attended more than 80% of all individual sessions; [2] phone consultation was provided by their primary therapist either during or outside office hours, specifically when BPD patients were experiencing a crisis. This facility was used less than 2 times per month; [3] weekly group, skills-training with other BPD patients, lasting 2-2.5 hours per session. These sessions focused on learning and practicing adaptive skills (e.g., role play, explaining and discussing home assignments), not on personal or specific complaints of the patients, and included four modules: 'mindfulness skills', 'interpersonal effectiveness skills', 'the emotion regulation skills', and 'skills for coping with a crisis'. Any specific or personal issues were redirected and discussed in the individual psychotherapy sessions. After one half year of treatment (26 weeks), participants had worked through all skills training modules which were then repeated in the second half year of DBT (another 26 weeks). During these sessions, the therapist had a guiding role in practicing the various skills. Patients attended more than 80% of all skills-training sessions; [4] weekly supervision and consultation meetings for the therapists.

Procedure

Participants in pre-treatment provided written consent after they had received information on our study and were guaranteed confidentiality in the collection and maintenance of the data. Participants were assessed at three time points: at pre-treatment, after a half year of DBT and at post-treatment after 1 year of DBT. Assessments were done by trained psychologists and master psychology students with clinical experience. Each assessment started with a brief introduction and general instructions after which the questionnaires were administered in paper and pencil format. Participants were free to ask questions and to skip personally sensitive questions (which were rated as missing values) when they were emotionally unable to cope.

Data Analyses

Pre-treatment coping style data ($N=19$) were used to compare the scores on active and passive coping of our BPD sample with norm scores from a female sample of the normal population used to validate the UCL (Schreurs *et al.*, 1993) by means

of a *t*-test. Furthermore, Spearman rho correlations on the pre-treatment data ($N = 19$) were calculated to determine whether self-injury behavior was related to active and passive coping.

Our main analyses focused on changes in the use of self-injury and coping strategies during the first half year of treatment ($N = 11$). In this period BPD patients completed all treatment components once. As the group that also completed treatment after the second half year was too small ($N = 5$), we only give an illustrative description of changes during this time, for this subgroup. *Reliable Change Indices (RCI*; Jacobson & Truax, 1991) were used to determine whether a statistically significant change had occurred (in addition to those attributable to chance, measurement error, and practice effects) in the use of these coping strategies and self-injury behaviors during DBT. The *RCI* requires data on the reliability and standard error of measurement of the instruments that are used to derive a ninety percent confidence interval. Any change score that exceeds the confidence interval at either end of the distribution (decrease or increase) represents a statistically reliable change that would occur in a normal population less than 5% of the time ($RCI \geq 1.96$). For this study, the reliability (Cronbach's alpha) and standard error data of the UCL (Schreurs *et al.*, 1988) and BPDSI (Arntz *et al.*, 2003) were used. Only changes on the individual, self-injury behaviors and coping strategies were analyzed, as we only had normative data on these behaviors. Finally, Spearman rho correlations were calculated to determine whether changes in self-injury behavior were related to changes in coping.

RESULTS

Hypothesis 1. The average scores on the various measures of self-injury and coping are presented in Table 1. We found that (general) self-injury was used on average 10 times per three months. However, caution should be paid when interpreting this finding as participants' self-injury behaviors varied substantially and self-injury scores were skewed. Participants most frequently used hitting, pinching, and cutting oneself (between two and three times in three months) as self-injury behavior. With respect to coping, we found that our BPD sample used significantly more passive coping than active coping (total active-passive coping score = -6.68, $SD = 10.71$) compared to a subsample of the normal population (total active-passive coping score = 16.20, $SD = 14.17$): $t(729) = 6.98$, $p < 0.01$) We found that participants used passive coping 'sometimes' or 'often' ($M = 2.55$, $SD = .36$) on average, whereas active coping was used 'hardly/never' or 'sometimes' ($M = 1.83$, $SD = .54$).

Hypothesis 2. We found no significant relations between self-injury and coping behaviors ($N = 19$, $p > .10$), although we found some indication for a positive relation between self-injury and passive reaction ($\rho = .23$, $p = .35$), a negative relation between self-injury and active coping in general (i.e., the mean of all active coping strategies; $\rho = -.28$, $p = 0.24$), active handling ($\rho = -.30$, $p = .21$), and reassuring thoughts ($\rho = -.36$, $p = .14$), and indication for a negative relation between social coping and self-injury ($\rho = -.27$, $p = .26$).

Table 1. Mean Raw Scores and Standard Deviations at Pre-treatment.

	<i>M</i>	<i>SD</i>	Scale	Skewness
Self-injury	11.16	13.66	0-80	1.30*
Hit	2.42	3.67	0-10	1.11*
Pinch	3.21	4.39	0-10	.70
Bite	.32	1.00	0-10	3.34*
Pull Hair	.32	1.00	0-10	3.34*
Cut	2.63	4.03	0-10	.95
Burn	1.11	2.98	0-10	2.76*
Needles	.21	.92	0-10	4.36*
Other	1.06	2.54	0-10	2.32*
General passive coping	7.66	1.01	4-12	-.67
Avoidance	2.34	.43	1-4	-.34
Expression of emotions	2.30	.76	1-4	-.26
Passive reaction	3.02	.39	1-4	-.09
General active coping	5.92	1.55	4-12	1.05*
Active handling	1.83	.56	1-4	.86
Reassuring thoughts	1.83	.69	1-4	.69
Palliative reaction	2.26	.58	1-4	.07
Seeking social support	1.79	.70	1-4	.48

Note. Descriptive statistics reported in this table concern the variables in their original metric ($N=19$); self-injury= average score on all self-injury measures; hit= hit oneself, or hit or graze against something with your head, fist, knuckles, or other body parts; pinch= pinch or scratch oneself; bite= bite oneself; pull hair= pull one's own hair; cut= cut or carve oneself; burn= burn oneself; needles= prick oneself with needles; other= other self-injury behaviours; general passive coping= average score of avoidance, expression of emotions, and passive reaction; general active coping= average score of active handling, palliative reaction, and reassuring thoughts. * $p < .05$

Hypothesis 3. The final aim of our study was to assess the development of self-injury and coping during DBT. The development of self-injury is presented in Table 2. We found that a large number of the participants (86%) who initially showed self-injury, made significantly less use of at least one of the self-injury behaviors after one half year of treatment. A moderate to high percentage of these patients showed statistically significant decreases in hitting oneself, pinching oneself, cutting oneself, biting oneself and pricking needles into one's body whereas only a relatively small percentage of these patients showed increases in one or more self-injury behaviors (29%). Significant increases were found among: hitting, pinching, cutting, and burning oneself. No changes were found for the self-injury behavior 'pulling one's hair'.

Findings on the changes of various coping strategies during DBT are also promising (Table 3). After one half year of treatment, a moderate number (36%) of patients showed a statistically significant increase in the use of one or more active coping strategies, whereas no decreases in using active coping strategies were found. As expected, more significant decreases than increases were found in the use of passive coping after a half year of treatment. A moderate percentage of the patients (27%) showed significant decreases in the use of passive coping strategies. Only one (9%) of the patients showed a statistically significant increase in the use of a passive coping strategy: avoidance. For social coping, which contains both active as well as passive coping elements, only

Table 2. Self-injury Behaviours during Pre-treatment (T0), after the First Half Year of Treatment (T1), and after the Second Half Year of Treatment (T2).

Case	Hit		Pinch		Bite		Pull Hair		Cut		Burn		Needles		Other	
	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1
1	0	0	0	10	9*	7*	0	0	?	0	0	0	0	0	0	0
2	3	0*	0	7	2*	0*	0	2*	0	0	0	0	0	0	0	0
3	8	0*	0	3*	0*	0*	0	0	0	0	0	0	0	0	0	0
4	0	0	3*	0	0	0	0	0	0	9	5*	2*	1	4*	1*	0
5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	?
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	?
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	4*	0	7	0*	0	0	0	0	0	0	0	0	0	0	0
8	0	1	0	0	8*	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	1*	4	1*	0	0	0	0	0	0	0	0
10	0	0	0	10	8*	0	0	0	0	0	0	0	0	0	0	8
11	7	7	8	0*	0	0	0	0	0	8	5*	0	0	0	0	0

Notes: * = significant change ($p < .05$); T0 = pre-treatment score; T1 = score after the first half year of treatment ($N = 11$); T2 = score after the second half year of treatment ($N = 5$); ? = missing value.

Table 3. Use of Coping Strategies during Pre-treatment (T0), after the First Half Year of Treatment (T1), and after the Second Half Year of Treatment (T2).

Case	Avoidance		Passive reaction		Expression of emotions		Active handling		Reassuring thoughts		Palliative reaction		Seeking social support	
	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1
1	1.63	2.00	2.38	3.29	2.71	2.14	3.00	3.00	2.00*	2.00	2.29	2.57	1.40	1.80
2	2.13	1.63	2.63*	2.71	3.00	2.57	1.33	2.00	1.33	1.43	1.57	2.14	1.20	1.40
3	2.38	2.50	2.00	2.43	2.29	1.86	2.67	2.33	1.67	1.71	2.86*	2.71	1.60	2.40*
4	2.63	2.63	2.50	2.57	2.29	2.43	3.33	2.33*	2.67	1.14	1.57	1.14	1.80	3.00*
5	2.25	2.50	2.25	3.43	3.00	2.14*	2.00	1.33	1.33	3.00	3.14	3.29	2.80	2.80
6	2.75	2.75		3.57	2.43*		2.67	2.67		1.29	2.14*		2.20	1.80
7	2.63	3.00		3.14	3.00		1.33	1.67		1.71	2.14		1.00	1.00
8	1.88	2.13		2.71	2.86		1.67	2.33		2.43	2.57		1.00	1.00
9	3.00	2.25*		2.57	1.29*		1.00	2.00*		1.43	2.71		2.00	2.60
10	2.13	1.88		3.14	3.00		2.33	2.33		2.00	1.86		2.00	2.00
11	3.13	3.25		3.14	3.00		1.67	1.33		1.57	1.71		1.60	1.20

Notes: * = significant change ($p < .05$); T0 = pre-treatment score; T1 = score after the first half year of treatment ($N = 11$); T2 = score after the second half year of treatment ($N = 5$).

significant increases were found after the first half year of treatment (22%). Overall, large changes were found among all coping strategies (changes ranged from 0.5-1.5 point on the four-point Likert scale).

In the second half year of treatment we found the same pattern of changes in self-injury and coping behaviors as in the first half year of treatment. However, the amount of change in self-injury (2 to 3 points on a scale of 0-10 in the second half year compared to 3 to 8 points in the first half year), and the number of changes in coping behavior were relatively smaller in the second half year of treatment compared to the first half year of treatment. No changes were found in social coping and active coping except for statistically significant increases as well as decreases in one coping strategy: palliative reaction. Statistically significant changes were found in all passive coping strategies. Except for an increase in passive avoidance coping (among a small percentage of the participants), the use of passive coping decreased for a small to moderate percentage of the participants.

Finally, we checked whether the participants' changes in self-injury behavior were related to their changes in coping behavior. Except for a positive relation between a reduction in avoidance coping and self-injury during the first half year of treatment ($\rho = .82$, $p < .05$), changes in passive and active coping were not significantly related to changes in the use of self-injury behaviors.

Although non-significant, we found indication for small ($\rho = .20$) to moderate ($\rho = .40$) correlations between changes in self-injury and coping behavior, the majority in the expected directions (only changes in self-injury in relation to active handling: $\rho = .33$, $p = .47$, and passive reaction: $\rho = -.32$, $p = .49$, after the first half year of treatment were in the opposite direction): a reduction in self-injury being related to an increase in active coping strategies and a decrease in passive coping strategies (e.g., after the first half year of treatment, change in self-injury was positively related with change in general passive coping: $\rho = .46$, $p = .29$; after the second half year of treatment, change in self-injury was negatively related with change in general active coping $\rho = -.200$, $p = .80$, and positively related with change in general passive coping: $\rho = .80$, $p = .20$). The exception was that we found almost no indication for a relation between change in self-injury and changes in active coping strategies after the first half year of treatment (general active coping: $\rho = .07$, $p = .88$, reassuring thoughts: $\rho = 0$, $p = .99$, and palliative reaction: $\rho = .07$, $p = .88$).

DISCUSSION

The purpose of our study was to gain more insight into the use of self-injury and other coping strategies, their interrelations, and their development during Dialectical Behavior Therapy among patients with a Borderline Personality Disorder.

The findings of our study show that, in accordance with former research, self-injury, especially hitting, pinching and cutting oneself, was used relatively frequently (Giesen-Bloo *et al.*, 2010; Verheul *et al.*, 2003). Next to that, we found that passive coping was used more frequently than active coping compared to the normal population.

Although some indication was found for relationships between self-injury and (other) coping strategies in the expected directions (self-injury was negatively related to passive reaction, and was positively related to active coping, and social coping), none of these relations reached statistical significance. This might be due to the large percentage of zero-scores (which means that the behavior did not occur) on the self-injury behavior items, and the limited power of our study (due to the small number of participants correlations had to be at least .56 to reach statistical significance, assuming an effect size of .8). An alternative explanation for this finding could be that self-injury is actually unrelated to (most) coping strategies we assessed because it is a rather unique coping strategy used in very specific interpersonal contexts (Welch & Linehan, 2002). Furthermore, our results show not only that self-injury decreases during DBT, which was also the fact in earlier research on outpatients (e.g., Van den Bosch *et al.*, 2005; Linehan *et al.*, 2006; Verheul *et al.*, 2003), but also that passive coping decreases, and active coping increases during the course of the therapy.

In addition, our findings suggest that the largest reductions in self-injury and improvement in coping after one year of DBT were already established during the first half year of treatment. This is in line with former research of Linehan and colleagues (1991). One explanation could be that the skills-training caused a floor effect after the first half year of treatment. Possibly, participants strongly improved their skills in the first half year of treatment which already caused relatively large improvements in self-injury and coping. As the content of DBT's skills-training in the second half year is mainly a repetition of the skills-training in the first half year, possibly smaller additional improvements could be reached in this second period of treatment. However, given the small sample of participants who also completed the questionnaires after the second half year of treatment, this explanation should be considered tentative.

Finally, except for a positive relation between a reduction in avoidance coping and self-injury during the first half year of treatment, we did not find any significant relations between changes in self-injury and coping styles. This might be due to the small sample size as we did find some indication for a positive relation between changes in passive coping and changes in self-injury behavior during the first and the second half year of treatment, and for a negative relation between changes in active coping behaviors and changes in self-injury, but only in the second half year of treatment. A larger sample of BPD patients is needed to further study these relations and determine whether changes in self-injury and changes in (other) coping behavior could positively reinforce each other.

There are some limitations in the current study of which at least two should be mentioned here. First, the lack of a control group and randomization ultimately does not allow for making conclusions about any causal links between DBT and self-injury and various coping strategies. Second, self-injury and (other) coping behaviors were assessed with retrospective self-reports. Although self-reports, including retrospective self-reports, are widely used to assess certain personal qualities, they can suffer from bias in BPD (Ebner-Priemer, Kuo, Welch, Thielgen, Witte, Bohus, & Linehan, 2006). Lastly, caution should be paid on making any general conclusions on self-injury and coping behavior among BPD, because this study contained a small sample of BPD patients.

Notwithstanding these limitations, the present study includes several novel findings. It is one of the few studies in which not only general self-injury but also specific self-injury behaviors were reported. Also, further evidence is provided for that fact that BPD patients generally use more passive coping strategies than active coping strategies compared to a (normal) population sample. Most importantly, to the authors' knowledge it is the first study in which the development of coping strategies during DBT was directly examined. Our study shows that self-injury but also (other) maladaptive ways of coping with problems and emotions can be reduced, and that active, adaptive coping is stimulated during DBT. The illustrative description of changes in the second half year of DBT may also suggest that largest changes in self-injury and coping behavior are established in the first half year of treatment.

Although some indication is found for our idea that changes in coping and self-injury may be related to each other, this relation as well as its direction, i.e., whether coping influences self-injury, has to be further investigated within a larger sample. In addition, single case studies and longitudinal RCTs are needed to examine whether improvements in self-injury and especially coping behavior are due to DBT treatment and persist in time and whether these improvements can be generalized to the large, heterogeneous group of BPD patients.

The current findings on the development of self-injury behaviors and coping strategies during DBT are promising as they not only show that BPD patients' use of maladaptive coping strategies, including self-injury, can reduce during DBT, but also that the use of adaptive behaviors, such as active coping strategies can be stimulated during this treatment. Future research, specifically single case experimental studies, would be of help to assess the development of self-injury and coping during specific periods and in relation to specific elements of DBT, and to translate this knowledge to the clinical practice.

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