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The Effect of Imaginal Exposure Length on Outcome of Treatment for PTSD*

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The effects of prolonged imaginal exposure sessions (60 minutes; n = 60) were compared with those of shorter exposure sessions (30 minutes, n = 32) for patients with chronic posttraumatic stress disorder (PTSD). Consistent with the authors' hypothesis, patients who received 30-minute imaginal exposure sessions showed less within-session habituation than patients who received 60-minute exposure sessions. However, no differences between patients who received 60-minute and 30-minute exposure sessions emerged on improvement in PTSD-symptoms, state anxiety, depression, and end-state functioning, both at posttreatment and at 1-month follow-up. No group differences were found with regard to between-sessions habituation, number of sessions, and dropout rate. Results suggest that 30-minute imaginal exposure sessions are as effective as 60-minute exposure sessions and that within-session habituation may not be a necessary condition for successful treatment of PTSD. Future research is needed to replicate these findings and extend them to other clinical populations.

Several controlled studies have demonstrated the efficacy of prolonged exposure (PE) in ameliorating posttraumatic stress disorder (PTSD) and related psychopathology (e.g., Foa et al., 1999; Resick, Nishith,Weaver, Astin, & Feuer, 2002). Foa and Kozak (1986) invoked emotional processing theory to explain the mechanisms involved in the efficacy of exposure therapy for anxiety disorders. They proposed that exposure to feared situations, objects, or memories activates the pathological fear structure that underlies the disorder and modifies the pathological elements of the structure. Foa and Kozak further stated that this change in the fear structure is the essence of emotional processing, which is indicated by fear activation and by within- and between-sessions habitation of anxiety. In line with the emotional processing theory, several studies on other anxiety disorders than PTSD, found that, compared to relatively shorter and interrupted in-vivo exposure sessions, longer exposure sessions promoted greater within-session habituation as well as superior outcome (Chaplin & Levine, 1981; Rabavilas, Boulougouris, & Stefanis, 1976; Stern & Marks, 1973). However, the length of exposure sessions varied across studies, and some studies utilized imaginal exposure sessions whereas others utilized in vivo exposure sessions.

The present study addresses the question of whether, relative to shorter sessions, imaginal exposure sessions of longer duration yield superior outcome for patients with chronic PTSD. In the prolonged exposure (PE) protocol developed by Foa and her colleagues, sessions are 90-minutes long; the first imaginal exposure is 60 minutes,

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and the length of the remaining imaginal exposure sessions is 45 minutes (e.g., Foa & Rothbaum, 1998). This format was based on earlier findings from other anxiety disorders (e.g., agoraphobia; Foa & Chambless, 1978), which showed that anxiety levels began to decrease after approximately 50 to 60 minutes of imaginal exposure. However, as noted by Foa and Kozak (1986), the length of exposure needed for habituation may differ across disorders. To date, the length of imaginal exposure in PE for PTSD has not been investigated. In studies of exposure therapy, the duration of the sessions has varied between 45 minutes and 120 minutes (Rothbaum, Meadows, Resick, & Foy, 2000). The amount of time devoted to imaginal exposure, however, is not always specified in these studies. In some studies, fixed imaginal exposure duration was used; in others, the exposure was maintained until the "emotional reactions decreased" (Tarrier et al., 1999) or until "distress dropped" (Marks, Lovell, Noshirvani, Livanou, & Thrasher, 1998), i.e., until within-session habituation has occurred. Although, as noted above, Foa and Kozak (1986) regarded within-session habituation as an indicator of emotional processing, the relationship between within-session habituation and treatment outcome is ambiguous. Several studies found that between-session habituation, but not within-session habituation, was related to treatment outcome in exposure therapy for PTSD (Jaycox, Foa, & Morral, 1998; Van Minnen & Hagenaars, 2002). In addition, Jaycox et al. (1998) found no relationship between the duration of exposure and treatment outcome. These findings raise the question whether, or to what degree within-session habituation has to be established during prolonging imaginal exposure during PE sessions. Thus far, however, no PTSD study directly compared prolonged exposure sessions with "shorter" exposure sessions.

In the present study we compared patients who underwent imaginal exposure of 60-minutes duration, the maximum duration recommended by the PE treatment manual (Foa, Rothbaum, Riggs, & Murdock, 1991),with patients who received 30 minutes of imaginal exposure. We hypothesized that (a) patients who received 30-minute imaginal exposure sessions would show less within-sessions habituation than those receiving 60-minute exposure sessions; and (b) patients who received 30-minute imaginal exposure sessions would benefit less from treatment. We also expected that shorter imaginal exposure sessions would result in fewer dropouts than longer exposure sessions.

METHOD

Patients

Patients were referrals to a university outpatient clinic and an outpatient clinic specializing in the treatment of anxiety disorders, both in the Netherlands. All patients met *Diagnostic and Statistical Manual of Mental Disorders, Third Edition-Revised* (*DSM-III-R*; American Psychiatric Association [APA], 1987) or the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*; APA, 1994) criteria for chronic PTSD, established through clinical interviews, using the Dutch version of the Münich Diagnostic Checklists for Mood and Anxiety Disorders (Hiller, Zaudig, & Mombour, 1990) or the Dutch version of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID; First, Spitzer, Gibbon, & Williams, 1995). In total, 120 patients were diagnostically interviewed and screened. Of them, 16 were not included because they did not fulfill the PTSD diagnostic criteria, three patients were excluded because they did not speak Dutch, and two patients were excluded because of suicidal behavior. Four patients refused the treatment, and three patients received the treatment but refused being a participant in the study. The total number of patients in the study was 92.

The study was not set up specifically for comparing longer and shorter exposure sessions. The study was primarily designed to study predictive factors of treatment outcome in the 60-minute exposure sessions. However, in 1999, because of financial considerations established by insurance companies, the treatment sessions were limited to 30-minute exposure sessions. This natural change in treatment delivery gave us a unique opportunity to study the effect of exposure length on treatment outcome. The 60-minute group was treated between July 1995 and May 1999; the 30-minute group was treated between May 1999 and January 2002.

The group that received 60-minute imaginal exposure sessions was comprised of 60 patients, 24 men and 36 women, with a mean age of 34.2 years ($SD = 9.8$). They had experienced various types of traumatic events: having witnessed or having been involved in accidents ($n = 17$), sexual violence ($n = 16$), or (domestic or work-related) violence ($n = 27$). In 10 patients, the trauma had occurred in childhood, and in 50 patients, in adulthood. Twenty-two patients had experienced multiple traumatic events; 38 had experienced a single traumatic event. At the beginning of the treatment, mean time since trauma was 5 years 11 months ($SD = 133.3$ months, range: 3–660 months). In addition to PTSD, seven patients had another diagnosis: panic disorder ($n = 4$), obsessive–compulsive disorder ($n = 1$), social phobia ($n = 1$), and eating disorder ($n = 1$).

The group that received 30-minute imaginal exposure sessions consisted of 32 patients, 5 men and 27 women with a mean age of 36.8 years ($SD = 12.3$) They had experienced the following traumatic events: having witnessed or having been involved in accidents ($n = 6$), sexual violence ($n = 13$), or (domestic or work-related) violence ($n = 13$). Seven patients had experienced their trauma in childhood and 25 patients in adulthood. Twelve patients had had multiple traumatic events in the past; 20 had experienced a single traumatic event. At the beginning of the treatment, mean time since trauma was 8 years 2 months ($SD = 125.4$ months, range: 5–516 months). In addition to PTSD, eight patients had an additional diagnosis; panic disorder ($n = 5$), social phobia ($n = 2$), and generalized anxiety disorder ($n = 1$).

Therapists

Therapists in both groups were psychologists who had been trained in prolonged exposure therapy for PTSD. Fourteen therapists treated patients in the 60-minute group. Eleven therapists, seven of whom also treated patients in the 60-minute group, treated patients in the 30-minute group. The treatments were supervised weekly for an hour by two experienced cognitive–behavioral therapists (one of them was the first author). The supervisors were the same for both groups. During each supervision hour, every patient was discussed. The therapist reported on the patients' progress and the clinical impressions. In case of problems, the supervisors offered possible solutions.

Procedure

All patients met the *DSM* criteria for PTSD as the primary diagnosis and had the disorder for at least 3 months. Exclusion criteria were not able to speak Dutch, prevalence of psychotic symptoms, and suicidal symptoms. In the 60-minute exposure sessions group, patients were informed that the study was set up to study effects on treatment outcome in general. Patients in the 30-minute exposure sessions group were informed more specifically about the reduction in both session and exposure time. All patients signed informed consent.

Assessments were conducted at pre- and posttreatments and at 1-month follow-up. Posttraumatic stress disorder symptom severity and subjective levels of distress during imaginal exposure were assessed each session. All treatments and assessments were conducted in Dutch.

Design

The groups were not randomly assigned to the two treatments as they were treated in successive time periods. Thus, a quasi-experimental design was used. All patients who were treated in the earlier period received 60-minute imaginal exposure sessions and all those treated in the later period received 30-minute imaginal exposure sessions. Thus, the only criterion for assigning patients into a treatment group was the period in which they were treated. No additional selection criteria were used.

Treatment

The treatment was manualized and consisted of 10 weekly sessions, 9 of which included prolonged imaginal exposure sessions. In the first session, patients were educated about PTSD symptoms and about the treatment rationale. In session 2–10, patients were instructed to recount aloud the

traumatic event in the first person and in the present tense with closed eyes. They were further instructed to imagine the traumatic event as vividly as possible, as if the trauma was happening "here and now." They were asked to recount the traumatic memory and to focus on details of the event, as well as their emotions, and thoughts. Throughout the imaginal exposure, anxiety levels were monitored every 5 minutes using the SUDS (Subjective Units of Distress Scale, range: 0–10). Each exposure session was audiotaped and as "homework," patients were asked to listen to the tape five times a week at home. In addition to this homework audiotape listening, patients were given in vivo exposure assignments. The in vivo assignments were initiated after the second imaginal exposure session, and included real-life exposure to fearful stimuli related to the trauma, such as visiting the trauma place or watching a movie related to the trauma.

The treatment was identical for both groups, except for the duration of the session and of the imaginal exposure. For the long-imaginal exposure group, the total session duration was 90 minutes. During each session, 60 minutes were devoted to imaginal exposure. For the short-imaginal exposure group, the total session duration was 60 minutes. During each session, 30 minutes were devoted to imaginal exposure. To control strictly for duration, the exposure duration was fixed. So, when necessary, the traumatic memories were repeated until the prescribed duration of the exposure was reached.

After the 10th treatment session, patients had a treatment pause of one month, then they underwent a follow-up (FU) assessment. After the FU assessment, additional treatment sessions were provided when necessary.

Treatment integrity. For each patient, two or three tapes of all the treatment sessions were randomly selected and coded for treatment protocol adherence by two doctoral students in clinical psychology. Specifically, they checked whether imaginal exposure was performed during the session, and whether in vivo exposure assignments were provided. In addition, the duration of the imaginal exposure was established. No significant deviations from the protocol were detected, although the duration of the imaginal exposure sessions varied somewhat from one patient to another: In the 60-minute group, the duration varied between 54 and 61 minutes ($M = 59.4$, $SD = 1.3$), and in the 30-minute group, between 27 and 30 minutes ($M = 29.2$, $SD = 1.0$).

Measures. The primary outcome measure was the Dutch version of the PTSD Symptom Scale-Self-Report (PSS-SR; Foa, Riggs, Dancu, & Rothbaum, 1993; Dutch translation; Engelhard, Arntz, & van den Hout, 2006). The items (range: 0–3) provide both diagnostic and severity information about each of the 17 *DSM-IV* criteria for PTSD. The total score ranges from 0 to 51. Higher scores indicate more psychopathology. The scale contains three subscales: re-experience, arousal, and avoidance. The PSS-SR showed good reliability and validity in a sample of female assault victims (Foa et al., 1993). The Dutch version showed good internal consistency (Cronbach's $\alpha = .85$–$.95$), and good concurrent and convergent validity (Engelhard et al., 2006). Foa et al. (1999) used a clinical cutoff score of 20 on the PSS-SR. The PSS-SR was assessed at pre- and post-treatment, at FU, and at the beginning of each treatment session. Patients scored their symptoms of the past week.

Secondary outcome measures were general anxiety and depression. The Dutch version of the State and Trait Anxiety Inventory (STAI: Spielberger, Gorsuch, & Lushene, 1970; Van der Ploeg, Defares, & Spielberger, 1980) was administered. In this study, data are reported on the State Anxiety Scale (STAI-State; Spielberger et al., 1970; Van der Ploeg et al., 1980) as a measure of general anxiety. This includes 20 items, each ranging from 0 to 4. Higher scores indicate more anxiety.

The SCL-90-R was administered (Dutch adaptation: Arrindell & Ettema, 1986). In this study, the depression subscale of the SCL-90-R is reported as a measure of depression. This subscale consists of 16 items, each ranging from 1 to 5. Internal consistency of this subscale is good (Cronbach's $\alpha = .82$–$.93$). Higher scores indicate more depression. With regard to clinical cutoff scores, a score within the range of 18 to 22 is considered a mean score in a normal population; a score within the range of 44

to 50 is considered a mean score in an outpatient clinic population. General anxiety and depression were assessed at pre-and posttreatment and at FU.

During the exposure sessions, subjective anxiety levels were monitored regularly using the Subjective Units of Distress Scale (SUDS), a 10-cm visual analogue scale ranging from 0 (*no anxiety*) to 10 (*maximum level of anxiety*). Several scores on the SUDs were obtained in each session: At the beginning of the exposure (SUD start), every 5 minutes during the exposure, and at the end of the exposure (SUD end). Patients were asked to rate their level of anxiety by crossing a point on the 0–10 line. Their scores were later measured in centimeters.

Data Analytic Plan

First, the two groups were compared with respect to pretreatment variables: pretreatment symptom severity, trauma characteristics, and demographics.

Treatment outcome was assessed in several ways. The two groups were compared with regard to changes from pretreatment scores to posttreatment and FU score, using repeated measures ANOVAs. ANOVAs were performed for both intent to treat samples and completers. In the intent-to-treat analysis, the last available value was carried forward. Because the two groups differed in gender, gender was entered in all the ANOVAs as a between-groups factor in addition to exposure duration. Within group effect sizes were calculated using Cohen's *d* for repeated measures (Cohen, 1988).

The groups were also compared in terms of the number of patients who reached good end-state functioning defined as being at or below a specific score on all three outcome measures. Following Foa et al. (1999) for the PSS-SR a cutoff of 20 was used, for state anxiety scores below the posttreatment means for our sample ($M = 46.3$), and for depression (scores below the posttreatment means for our sample on the SCL-90-depression ($M = 33.7$).

Between-session and within-session habituation was calculated following previous studies (see Jaycox et al., 1998; Kozak, Foa, & Steketee, 1988; Van Minnen & Hagenaars, 2002). For each session, the highest SUD score was defined as the peak SUD score. Between-session habituation over all imaginal exposure sessions (S2-S10) was calculated by subtracting the peak SUD of session 10 from the peak SUD of Session 2. The degree of within-session habituation was computed by subtracting the end SUD rating from the peak SUD rating in S2 and S10. Differences in within-session habituation and between-session habituation were analyzed using independent *t* tests. Seven patients had missing SUDs ratings for one session. The SUDs scores of the foregoing sessions were used for missing sessions (last observation carried forward).

Homework adherence was measured by the percentage of time patients listened at home to the tape. They were instructed to listen to the tape at home five times in the week following a treatment session, so five times a week was set at 100%. Homework adherence was computed for each week separately. Mean homework adherence was computed by summing all week homework percentages divided by the number of sessions.

To control for the alternative hypothesis that an absence of outcome differences between treatments was due to the fact that therapists became more skilled over time, the repeated measures ANOVA analysis was repeated for the primary outcome measure, PTSD symptoms, including only completed patients who were treated by experienced therapists, defined as therapists who treated patients in both the 60-minute group and the 30-minute group. In addition, in the 30-minute group we compared the end-state functioning at posttreatment and follow-up for therapists who had also treated patients in the 60-minute group (experienced therapists) and therapists who did not treat patients in the 60-minute group (less-experienced therapists).

Because specific hypothesis were formulated regarding drop-out rate and within-session habituation, one-sided statistical tests were performed on these variables.

For the primary outcome measure (PSS-SR), a statistical power of 80% to detect differences between the 60-minute and 30-minute groups was estimated as a total of 78 patients. Moderate differences in effect, that is Cohen's *d* of 0.5, were considered as relevant. For categorical measures, a statistical power of 80–90% to detect differences between

the two groups was estimated at a total of 89 patients (see Dunlap & Myers, 1997).

RESULTS

Comparability of Groups

No significant differences between groups emerged on pretreatment symptom severity: PTSD-symptoms, $t(90) < 1$; depression, $t(90) < 1$; STAI-State, trauma characteristics—duration since trauma, $t(90) < 1$; multiple versus single trauma, $\chi^2 < 1$; trauma during childhood versus adulthood, $\chi^2 0$, and demographics—age, $t(90) < 1$, except for gender. The 60-minute group had more male patients, $\chi^2(1, N = 92) = 5.74$, $p < .05$. Therefore, gender was included as a between-group factor in addition to duration of exposure in the repeated meaures analyses.

In the 60-minute group 14 patients (23.3%) dropped out, whereas 5 patients (15.6%) dropped out in the 30-minute group. The differences in dropout rate were not significant, $\chi^2 < 1$.

Treatment Outcome

Table 1 shows the treatment outcome measures at pretreatment, posttreatment and at 1-month follow-up, as well as within-group effect sizes for the Intent to Treat (ITT) 60-minute and 30-minute groups. Repeated measures (Time × Duration of Exposure × Gender) revealed a significant effect of time on all outcome measures: PSS-SR Total, $F(2, 87) = 31.13$, $p < .001$; SCL-90-R

Table 1. Means, Standard Deviations, and Effect Sizes on Outcome Measures for Intent to Treat 60-Minute ($N = 60$) and 30-Minute ($N = 32$) Groups at Pre- and Posttreatment and 1-Month Follow-Up (FU)

Outcome measures	Pretreatment		Posttreatment			FU 1 month		
	M	*SD*	*M*	*SD*	ES	*M*	*SD*	ES
60-Minute Group								
PSS-SR								
Re-experience	8.5	3.5	4.5	4.4	1.0	4.3	4.0	1.1
Arousal	7.9	3.4	5.0	3.9	0.8	5.0	3.8	0.8
Avoidance	9.5	3.9	5.3	4.8	1.0	5.6	5.2	0.9
Total score	25.9	8.8	14.8	12.1	1.1	14.7	12.0	1.1
SCL-90-R								
Depression	40.2	13.9	33.7	14.9	0.5	33.5	15.1	0.5
STAI								
State	55.1	12.1	47.4	16.1	0.5	47.0	15.4	0.6
30-Minute Group								
PSS-SR								
Re-experience	7.6	3.5	3.6	3.8	1.1	3.3	3.7	1.2
Arousal	8.5	3.1	5.7	3.3	0.9	5.5	3.3	0.9
Avoidance	10.6	4.6	4.6	4.5	1.3	4.9	4.5	1.3
Total score	27.2	10.0	14.3	10.7	1.3	14.2	10.3	1.3
SCL-90-R								
Depression	42.8	14.3	33.9	15.2	0.6	33.9	15.3	0.6
STAI								
State	53.4	13.0	44.2	13.5	0.7	45.0	13.8	0.6

Note. ES = Effect Sizes; PSS-SR = PTSD Symptom Scale Self-Report; SCL 90-R = Symptom Checklist Revised; STAI = State Anxiety Inventory.

Depression, $F(2, 87) = 9.51$, $p < .001$; and STAI-State, $F(2, 87) = 10.01$, $p < .001$. No time by duration interactions effects were found: PSS-SR Total, $F = <1$, $\eta_p^2 = .008$; SCL-90-R Depression, $F < 1$, $\eta_p^2 = .003$; and STAI-State, $F < 1$, $\eta_p^2 = .005$), or time by duration by gender effects: PSS-SR Total, $F < 1$; SCL-90-R Depression, $F < 1$; and STAI-State, $F < 1$. Simple contrast analyses showed significant effects between pre- and posttreatment ($p < .001$), and between pretreatment and FU($p < .001$) for all outcome measures.

These findings indicate that in the entire sample, patients showed a significant decrease in symptoms from pretreatment to posttreatment and 1-month follow-up, and that the amount of decrease did not differ between the 60-minute and 30-minute groups. The analyses limited to completers yielded the same pattern of results: PSS-SR Total, $F(2, 68) = 44.01$, $p < .001$; SCL-90-R Depression, $F(2, 68) = 9.46$, $p < .001$; and STAI-State, $F(2, 68) = 10.63$, $p < .001$. In addition, no interaction effects of time by exposure duration were found: PSS-SR Total, $F < 1$; SCL-90-R Depression, $F < 1$; STAI-State, $F < 1$. Interaction effects of time by duration by gender were also not found: PSS-SR Total, $F(2, 68) < 1$; SCL-90-R Depression, $F < 1$; STAI-State $F < 1$.

Within group effect sizes (Cohen's *d*) of the PTSD subscales and total scale were in both groups 0.8 or higher, indicating large treatment effects. When differences in effect sizes appeared, they favored the 30-minute group.

End-state functioning. No significant differences were found with regard to end-state functioning in the ITT groups. Based on the composite end-state criterion, 43.3% of patients in the 60-minute group versus 37.5% of patients in the 30-minute ITT group reached good end-state functioning at posttreatment, $\chi^2 < 1$. At follow-up, 43.3% of the patients in the 60-minute group and 46.8% in the 30-minute group reached good end-state functioning, $\chi^2 < 1$.

Influence of therapist level of experience. To examine the effect of experience level of therapists on outcome, we first repeated the repeated measures ANOVA for the primary outcome measure, PTSD-symptoms, including only completed patients who were treated by experienced therapists ($n = 48$). No interaction effect of time by duration was found, $F < 1$, indicating that the therapists who treated patients in the 60-minute treatment group did not perform better in the 30-minute group.

In addition, we compared the end-state functioning of patients in the 30-minute group who were treated by relatively experienced therapists ($n = 18$, good end-state at posttreatment = 38.8%, FU = 50%) with patients who were treated by relatively inexperienced therapists ($n = 9$, good end-state at posttreatment = 33.3%, FU = 44%). The differences were not significant, posttreatment, $\chi^2 < 1$, *ns*, FU = $\chi^2 < 1$, *ns*. This indicates that in the 30-minute group the experienced therapists did not treat patients significantly better than inexperienced therapists.

Number of sessions required for a meaningful reduction in symptoms. Figure 1 depicts the process of symptom reduction during treatment. PSS-SR scores are depicted at pretreatment, in each session, at posttreatment and at FU for the ITT groups. Repeated measures ANOVA revealed a significant time effects across all the assessment points, $F(12, 77) = 5.95$, $p < .001$. Again, no significant interaction effect of time by duration was found, $F(12, 77) = 1.32$, *ns*, and no interaction effect of gender by time by duration, $F < 1$.

To compare the groups with regard to the number of sessions needed for improvement, we determined for each patient in which session a drop of 50% from pretreatment in PSS-SR symptoms was reached. The 60-minute group needed on average 6.8 sessions ($SD = 3.1$) to reach a 50% decline in symptoms, and the 30-minute group required 7.2 sessions ($SD = 3.0$). This difference was not significant, $t < 1$.

Within-session habituation. Figure 2 shows the mean SUDs scores for both completer groups in all exposure sessions (S2–S10). Visual inspection shows that both groups largely follow the same pattern during the first 30 minutes. Consistent with our hypothesis, in most sessions, the 60-minute group shows in the last 30-minutes a further

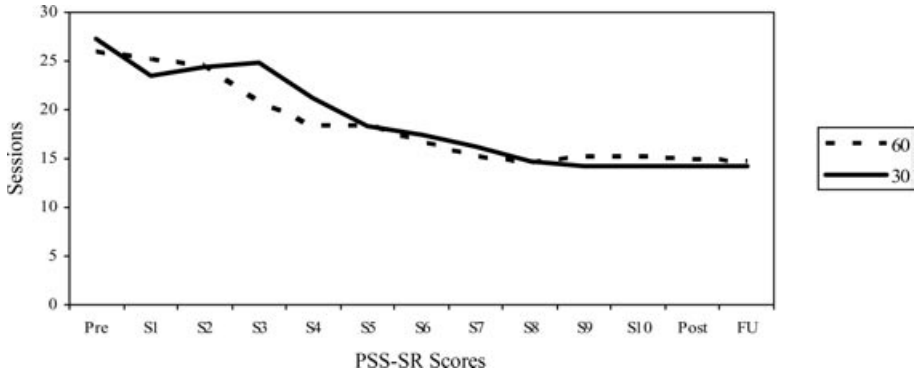

Figure 1. Session-by-session PTSD Symptom Scale-Self-Report (PSS-SR) scores for 60- and 30-minute exposure Intent to Treat (ITT) groups.

decline in SUDs scores, indicating more within-session habituation.

The first (S2) and last exposure session (respectively, S2 and S10) were analyzed more closely. Table 2 presents data on habituation within and between those sessions. As hypothesized, patients in the 60-minute group showed significantly more within-session habituation than patients in the 30-minute group in S2, $t(71) = 3.45$, $p < .001$, and S10, $t(71) = 3.45$, $p < .05$. Within-session habituation was not significantly related to PTSD symptoms at posttreatment, S2 $r = -.05$, *ns*; S10 $r = -.16$, *ns*, or at FU, S2 $r = -.13$, *ns*; S10 $r = -.15$, *ns*.

Between-session habituation. No significant difference between groups was found with regard to between-session habituation, $t(71) = -0.04$, *ns*). In contrast to within-session habituation, between-session habituation was significantly related to PTSD-symptoms at posttreatment, $r = -.30$, $p < .01$, and FU, $r = -.26$, $p < .05$.

Mean homework adherence was 93.5% in the 60-minute group across all sessions versus 98% in the 30-minute group. This difference was not significant, $t(59) = -0.60$, *ns*.

DISCUSSION

Consistent with our hypothesis, the group that received 60-minute imaginal exposure sessions showed greater within-session habituation than the group receiving 30-minute imaginal exposure sessions. Inconsistent with our hypothesis, however, was that no group differences emerged with regard to treatment outcome. Patients who received

Table 2. Within-Session Habituation and Between-Session Habituation Patterns Based on SUDs Ratings During First and Last Exposure Sessions for Completers

	60-Minute Group		30-Minute Group	
	M	*SD*	*M*	*SD*
S2 Peak	8.0	1.8	8.2	2.0
S2 End	4.9	2.9	7.0	2.3
S2 Within-session habituation	3.1	2.5	1.3**	1.2
S10 Peak	5.8	2.8	6.1	2.5
S10 End	4.1	3.0	5.0	2.7
S10 Within-session habituation	1.7	1.7	1.1*	1.2
Between-session habituation (S2–S10)	2.1	2.9	2.1	3.0

Note. SUDs = Subjective Units of Distress. S indicates session number.
Significantly different from *M* of 60-minute group, *$p < .05$, one-tailed. **$p < .001$, one-tailed.

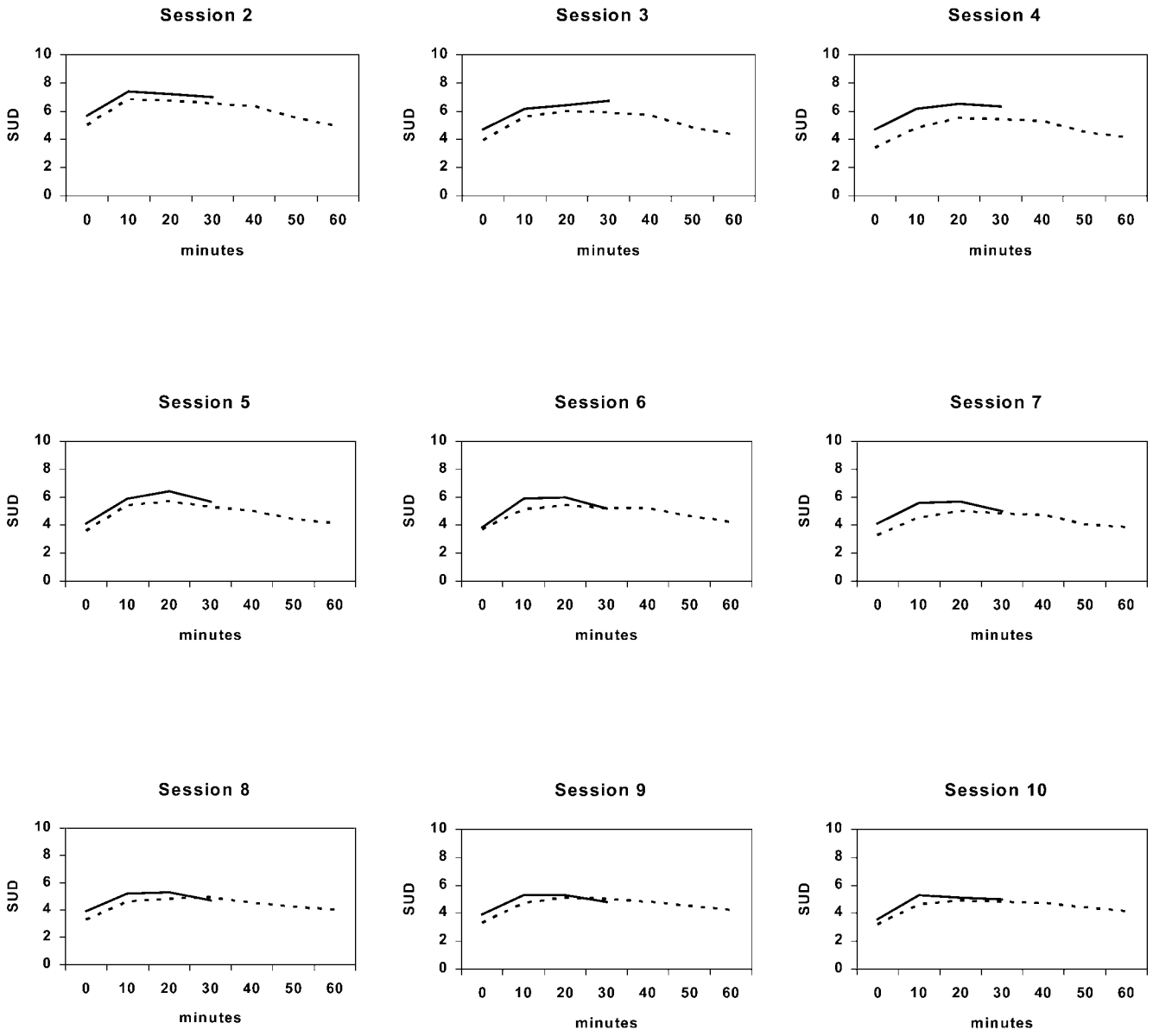

Figure 2. Subjective Units of Distress Scale (SUDs) scores per session for completers in 60- (dotted line) and 30-minute (solid line) exposure groups.

30-minute imaginal exposure sessions showed equal improvement at posttreatment and 1-month follow-up on PTSD, anxiety, and depressive symptom severity to patients who received 60 minutes of imaginal exposure. Furthermore, the end-state functioning of the 30-minute group was comparable with the 60-minute group, as were treatment effect sizes. In addition, the 30-minute group was not slower in responding to treatment. The present findings suggest that for some patients, the imaginal exposure component of exposure therapy programs for PTSD can be shortened without jeopardizing treatment efficacy. Although we did not find that 30-minute imaginal

exposure sessions led to fewer dropouts, shorter imaginal exposure sessions may be less burdensome to both patients and therapists. The sessions are also less costly; therefore, easier to implement in clinical practice. Nonetheless, these findings must be replicated in other clinical samples before clinical practice guidelines are modified.

What are the theoretical implications of the findings of this study? In the present study, as expected, patients who received 30 minutes of imaginal exposure showed less within-session habituation than patients who received 60 minutes of imaginal exposure. However, there were no group differences regarding the between-session habituation. Importantly, and consistent with this pattern, within-session habituation was not related to treatment outcome whereas between-session habituation was.

The findings of the present study are inconsistent with studies indicating that longer exposure sessions were more effective than shorter, interrupted exposure sessions (Chaplin & Levine, 1981; Rabavilas et al., 1976; Stern & Marks, 1973). They are, however, consistent with previous studies in PTSD (Jaycox et al., 1998; Van Minnen & Hagenaars, 2002) and in obsessive–compulsive disorder (Kozak et al., 1988) in which within-session habituation was not related to treatment outcome. Other evidence that within-session habituation may not be a necessary condition for symptom improvement are the findings that agoraphobics who were allowed to escape from their feared situation before their anxiety decreased improved as much as patients who were instructed to stay in the situation until the core erroneous evaluation of fear diminished (de Silva & Rachman, 1984; Emmelkamp, 1974; Rachman, Craske, Tallman, & Solymon, 1986).

Are the results of the present study inconsistent with Foa and Kozak's (1986) emotional processing theory? The theory suggested that two conditions are necessary for exposure therapy to be effective: fear activation and the availability of information that is inconsistent with the pathological elements in the fear structure that underlies the target anxiety disorder. Foa and Kozak further proposed that within-session habituation is important only for patients who hold the erroneous belief that anxiety "stays forever unless escape is realized" because for these patients within-session habituation contains information that disconfirms their erroneous evaluation. It is entirely possible that this belief is not part of the core erroneous cognitions of PTSD sufferers. Indeed, Foa and colleagues (e.g., Foa & Rothbaum, 1998) posited that the core erroneous cognitions in PTSD are that the world is entirely dangerous and that the self is completely incompetent. Accordingly, successful treatments should modify these cognitions. Consistent with emotional processing theory of PTSD, Foa and Rauch (2004) found that prolonged exposure reduced negative cognitions about the world and the self, and that this reduction was strongly correlated with reduction in PTSD symptoms following the treatment. In a later elaboration of emotional processing theory, Foa and McNally (1996) proposed that exposure therapy does not modify the existing pathological fear structure, but instead forms a new structure, which does not contain the erroneous associations and evaluations of the old structure and is more readily accessible for retrieval. Brewin, Dalgleish, and Joseph (1996) have also proposed similar ideas. These theoretical considerations suggest that the critical factor in exposure therapy is the formation of new associations rather than within-session habituation or the duration of exposure per se.

There are several important limitations of this study. Most important, patients were not randomized to the two treatment conditions. Although, except for gender, no significant differences were found between the two groups at pretreatment on symptom severity, trauma characteristics and demographics, one could still argue that in the lack of a randomization design, the groups may be different in other aspects. Although we found no support for the hypothesis that the lack of differences between the two groups was due to therapists becoming more skilled over time, the treatment could be affected by the difference in time, by differences in treatment expectations, or by differences in treatment delivery, especially because therapists were not blind to the study hypothesis. Given the limitations of the study design, it is important to note that changes in the delivery of PE should await a replication of the results derived from well-controlled, randomized studies.

In this study, we followed the imaginal exposure sessions in a naturalistic, clinical way. That means that some

patients told the same traumatic memory several times during one treatment session, whereas others told only one part of a traumatic memory. In addition, some patients who were victims of a single trauma recounted the same traumatic memory repeatedly during the nine sessions, whereas victims of multiple traumas may have told several traumatic memories throughout the nine exposure sessions. It is important to note that the percentage of patients with single versus multiple traumas were equal in the two treatment groups. Nonetheless, future studies should examine whether the number of traumas that are subjected to imaginal exposure affects treatment outcomes.

Additional limitations of this study should be noted. Because of the sample size, the study was powered to detect only moderate differences between the groups. Further, the habituation measures were based on only subjective levels of distress. Future research should include objective measures of habituation, such as physiological measures (e.g., heart rate). The study also did not examine long-term effects of the two treatments and the outcome measures relied entirely on self-report. Finally, we do not know whether these results generalize to other trauma populations, such as war veterans, or populations of civilian trauma survivors with more traumatic experiences, more childhood trauma, and more comorbidity.

In summary, to our knowledge, this is the first study that directly addresses the issue length of imaginal exposure in treatment of PTSD and its relationship to outcome. The present study suggests that imaginal exposure sessions may be used in treatment of PTSD for some patients without compromising its efficacy. Given the limitations discussed above, however, this finding needs to be replicated using more rigorous methodology and with populations of trauma survivors before clinical practice guidelines are modified.

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