

# Treatment of Posttraumatic Stress Disorder by Exposure and/or Cognitive Restructuring

## A Controlled Study

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**Background:** Unanswered questions from controlled studies of posttraumatic stress disorder concern the value of cognitive restructuring alone without prolonged exposure therapy and whether its combination with prolonged exposure is enhancing.

**Methods:** In a controlled study, 87 patients with posttraumatic stress disorder of at least 6 months' duration were randomly assigned to have 10 sessions of 1 of 4 treatments: prolonged exposure (imaginal and live) alone; cognitive restructuring alone; combined prolonged exposure and cognitive restructuring; or relaxation without prolonged exposure or cognitive restructuring.

**Results:** Integrity of audiotaped treatment sessions was satisfactory when rated by an assessor unaware of

the treatment assignment. Seventy-seven patients completed treatment. The pattern of results was similar regardless of rater, statistical method, measure, occasion, and therapist. Exposure and cognitive restructuring, singly or combined, improved posttraumatic stress disorder markedly on a broad front. Gains continued to 6-month follow-up and were significantly greater than the moderate improvement from relaxation.

**Conclusion:** Both prolonged exposure and cognitive restructuring were each therapeutic on their own, were not mutually enhancing when combined, and were each superior to relaxation.

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**I**N RANDOMIZED controlled treatment trials (RCTs) for posttraumatic stress disorder (PTSD), superiority to pill placebo was found for phenelzine and imipramine,<sup>1</sup> amitriptyline,<sup>2</sup> fluoxetine,<sup>3</sup> and alprazolam.<sup>4</sup> In RCTs of psychotherapy, behavioral/cognitive therapy for PTSD had an effect up to 3 to 12 months after treatment. In Vietnam veterans, imaginal exposure was better than discussion plus problem solving,<sup>5</sup> or being on a waiting list,<sup>6</sup> or than counseling within a structured inpatient program.<sup>7</sup> In PTSD after mixed traumas, imaginal and live exposure were equally therapeutic,<sup>8</sup> and image habituation training, eye movement desensitization, and applied muscle relaxation were all helpful—all included exposure.<sup>9</sup> In PTSD mostly after bereavement, desensitization, hypnosis, and psychodynamic therapy were each helpful and better than being on a waiting list.<sup>10</sup> In rape survivors, exposure (imaginal and live) and stress inoculation (relaxation, thought-stopping, cognitive restructuring, self-dialogue, modeling, and role play—no exposure) were each better than support with problem solving (no exposure) or being on a waiting list.<sup>11</sup>

Still unknown is whether cognitive restructuring alone helps PTSD as much as does prolonged exposure alone, whether the 2 combined do better than each alone, and how they compare with relaxation that contains neither and is largely a placebo in panic/agoraphobia and obsessive-compulsive disorder. The present RCT concerns these questions in outpatients with PTSD after a range of traumas and reports the main outcome.

## RESULTS

### PATIENT FLOW

One hundred nine patients met the inclusion criteria and were offered treatment; 22 refused and 87 began treatment (23 in the E group, 19 in the C group, 24 in the EC group, and 21 in the R group). Of the 87 trial entrants, 10 (3 in the E group, 1 in the C group, 5 in the EC group, and 1 in the R group; *P* not significant) dropped out before becoming evaluable at week 6 (reasons seldom given) and 77 (20, 18, 19, and 20 in the E, C, EC, and R groups, respectively) completed 10 treatment sessions during a mean of 16 weeks.

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## PATIENTS AND METHODS

### DESIGN

Eighty-seven outpatients with PTSD were randomized to have 10, usually weekly, sessions of 1 of 4 treatments: (1) exposure (E); (2) cognitive restructuring (C); (3) combined exposure plus cognitive restructuring (EC); or (4) relaxation (R), a placebo control for therapist contact and for homework practice between sessions. Follow-up was at 11, 15, 24, and 36 weeks after entry.

Cell size needed for a power of 80%<sup>12</sup> between E and R was estimated at 13, based on mean ( $\pm$ SD) improvement in the Impact of Events Scale (see below)<sup>8</sup> of  $20\pm 15$ , a pre-treatment-posttreatment correlation of 0.5, and significance level of .05.

### PATIENTS

These were outpatients referred in 1992 through 1995 by professionals, Victim Support, police, ambulance and fire services, and the subjects themselves (9% only).

Inclusion criteria were as follows: PTSD (*DSM-III-R* criteria<sup>13</sup>) for 6 or more months; age of 16 to 65 years; and absence of melancholia or suicidal intent, organic brain disease, past or present psychosis, antidepressant drug (unless the patient had been receiving a stable dose for 3 or more months); and diazepam in a dose of 10 mg/d or more or equivalent, ingestion of 30 or more alcohol units a week, and past exposure or cognitive therapy for PTSD.

Referred patients were sent a screening questionnaire. Suitable respondents had a 2-hour screening interview covering diagnosis; the trauma and its aftermath; clinical features; impact; mental state; and Structured Clinical Interview for *DSM-III-R*<sup>14</sup> for PTSD, other anxiety disorders, and substance abuse. Suitable patients gave written consent, were rated in a second 2-hour interview, and were then randomly assigned in permuted blocks<sup>15</sup> of 20 to undergo E, C, EC, or R, stratified for personal (intended by someone) or impersonal (eg, accidents) trauma. The therapist (K.L. or S.T.) then learned the patient's treatment condition.

### TREATMENT

Therapists (K.L. and S.T.) used a procedure manual and 4 treatment manuals (developed with the help of experts in their fields) covering each session in each treatment condition. Patients had ten 90-minute individual-treatment sessions except in EC (see below), where sessions lasted 105 minutes. Sessions were audiotaped. In session 1, patients

were given their treatment rationale and an information sheet. The 4 treatment conditions were as follows.

### Exposure Therapy

Sessions 1 through 5 involved imaginal exposure to trauma memories. Patients were asked to talk in the first-person present tense about what they had undergone, their response, its meaning, what they had smelled, heard, saw, felt, and tasted; imagine and describe critical aspects of the trauma and "rewind and hold"<sup>16</sup> these until distress dropped (which took about 20 minutes); and for multiple traumas, relive whatever generated the most intrusions. Between sessions, patients were asked to listen to relevant parts of the audiotape of their last session for 1 hour daily and note this in a daily diary. They rated peak distress before sessions, during critical points in sessions, at the end of sessions, and during homework.

Sessions 6 through 10 involved prolonged live exposure through an agreed-on hierarchy of trauma-related stimuli that were feared, avoided, and disabling. Exposure was repeated and usually accompanied by a therapist (K.L. or S.T.). Between-session homework was live exposure for 1 hour daily, recorded with distress levels in diaries.

### Cognitive Restructuring

Patients were taught to spot dysfunctional thoughts and thinking errors, elicit rational alternative thoughts, and re-appraise beliefs about themselves, the trauma, and the world.<sup>17</sup> Exposure-type behavioral experiments were excluded. In early sessions, patients were helped to identify negative automatic thoughts and monitor them in daily thought diaries and evaluate them by probabilistic reasoning, Socratic questioning,<sup>18,19</sup> evidence for and against each thought, and pros and cons of their way of thinking. In later sessions, patients progressed to identify, appraise, and modify distorted beliefs about the trauma, self, world, and future.

Homework involved eliciting, monitoring, challenging, and modifying negative thoughts and beliefs and use of daily thought records. Most patients took home audiotapes of their sessions to listen to and information sheets about the rationale, recognizing negative thoughts, and challenging thinking errors.

### Exposure Combined With Cognitive Restructuring

Sessions 1 through 5 each involved 45 minutes of imaginal exposure, a 15-minute break, then 45 minutes of cognitive restructuring, often concerning thoughts that emerged during exposure. Sessions 6 through 10 were the same, but with live, not imaginal, exposure. An hour's daily

Of the 77 treatment completers, 52 (13, 12, 13, and 14 in the E, C, EC, and R groups, respectively) completed follow-up to week 36, and 25 patients (7, 6, 6, and 6 in the E, C, EC, and R groups, respectively) did not. Of these 25, 10 (4, 3, 1, and 2 in the E, C, EC, and R groups, respectively) were untraceable and 15 had to be withdrawn—12 (2, 2, 5, and 3, respectively) because continuing depression required more monitoring than protocol allowed during follow-up and 3 for other reasons (1 each in the R, E, and C groups).

At trial entry the 12 had, compared with the other 65 treatment completers, significantly more major depression, antidepressant medication, and current plus past depression.

### BASELINE FEATURES

The 4 treatment groups did not differ demographically. Only 6% of patients were taking anxiolytics. The E group had the least current major depression (**Table 1**), and

homework assignment was encouraged, consisting of exposure and cognitive tasks like those in the previous session, and daily recording of homework tasks in diaries.

### Relaxation

The therapist taught patients to relax.<sup>20</sup> For each of the first 3 weeks, patients heard a script on 1 of 3 relaxation audiotapes and took the audiotape home for daily hour-long relaxation homework. At session 4, patients chose whichever of the 3 tapes had been the most useful to use during weeks 4 through 10. If they chose segments across the 3 tapes, the therapist prepared 1 tape that included all those segments. Patients were asked to do an hour's relaxation homework daily and to record anxiety during the homework in a diary.

### THE THERAPISTS

A nurse therapist (K.L.) treated 53 patients during 3 years, and a clinical psychologist (S.T.) treated 34 patients during 2 years; each treated similar numbers across the 4 treatment conditions. Assignment to therapist was random. Both therapists were trained, highly experienced behavior-cognitive therapists.

### ASSESSMENT

#### Assessors and Rating Times

One assessor (a psychiatrist [H.N.] or a psychologist [M.L.]) screened each patient and rated him or her at weeks 0, 6, and 11 (posttreatment), and at 1-, 3- and 6-month follow-up thereafter. Assessors were kept unaware of the treatment condition.

#### Measures

There were 12 primary measures (shown in italic type below) and 22 secondary ones, mainly subscales of primary measures. Most ratings were at weeks 0, 6, and 11, and at 1-, 3- and 6-month follow-up. Higher scores almost always denoted more abnormality.

The PTSD measures were the Clinician-Administered PTSD Scale (CAPS 2)<sup>21,22</sup> (assessor rated), which measured the frequency and intensity of 17 DSM-III-R PTSD symptoms during the past week (each scored 0-4), 8 associated features (each scored 0-4), social and work impact, global improvement, and severity (each scored 0-4). The CAPS 2 primary measures consisted of CAPS 2—*total of 3 clusters and severity*. Two other PTSD measures were the *Impact of Events Scale* (IES)<sup>23</sup> (self-rated), which consisted of 15 items about intrusion and avoidance, with a score range of 0 to 75; and the PTSD Symptoms Scale<sup>24</sup> (self), 17 items rated 0 to 3 about frequency, with a score range of 0 to 51.

Other measures used were the *Beck Depression Inventory*<sup>25</sup> (self), 21 items with a score range of 0 to 63; the State-Trait Anxiety Inventory<sup>26</sup> (self), which included 20 State items, with a score range of 0 to 80; the Fear Questionnaire<sup>27</sup> (self), which included 15 phobia items and 5 anxiety-depression items, each rated 0 to 8, with a score range of 0 to 120 and 0 to 40, respectively; the General Health Questionnaire<sup>28</sup> (self), which included 28 items with a score range of 0 to 28; *Global Improvement* (self, score of 1-7; assessor, score of 1-9); *Problem* (Self and assessor, each rated at 0-8); *Total of 4 Goals*<sup>29-33</sup> to deal with the problem (self and assessor each scored 0-8); and *Work/Social Adjustment*<sup>29</sup> (self and assessor), which included 5 items about work, home management, social leisure, private leisure, and family relationships, each scored 0 to 8.

### STATISTICS

Nonparametric analyses were used for categorical variables, analyses of covariance (ANCOVAs) and analyses of variance (ANOVAs) for continuous ones. Outcome variables were analyzed separately instead of with a multivariate ANOVA to facilitate comparison with other studies' results. To test whether any behavioral-cognitive treatment was better than relaxation (E+C+EC vs R) and whether E was better than C and EC, ANCOVAs with the pretreatment score on the dependent variable as covariate were done separately at weeks 6 and 11 and 1- and 3-month follow-up, and at 6-month follow-up for E vs C.

Because the SPSS ANCOVA program could not make all post hoc pairwise comparisons between any 2 treatment conditions (E vs C, E vs EC, C vs EC, E vs R, C vs R, EC vs R), least-significant difference (LSD) pairwise comparisons were made on the basis of 1-way ANOVAs of change scores for all time points, including 6-month follow-up for non-R comparisons (by which time some unimproved patients in the R group had had alternative treatment, precluding use of R results then). The LSD pairwise comparisons were ignored when the ANCOVA was not significant for E vs C. The ANCOVAs controlled for pretreatment differences. Scheffé pairwise comparisons were also done and yielded a picture similar to that from LSD. For a few comparisons, *t* tests were done. Alpha was  $P < .05$ . Confidence intervals, percentage of patients improved, and effect sizes are also presented.

Analyses were done on all available data and, for primary measures, were also done on end-point imputed scores carrying forward noncompleters' last available ratings to the next rating point. Such imputation assumes that noncompleters continued unchanged, while analyzing available data assumes that noncompleters improved like completers. Each assumption is moot.

In this report, pretreatment refers to week 0 and post-treatment, to week 11.

the E and R groups had lower baseline scores than the C group on 5 primary and 7 secondary measures and than EC on 7 primary and 7 secondary measures (1-way ANOVA with LSD paired comparisons).

The trauma had occurred a mean ( $\pm$ SD) of 4 $\pm$ 5 years before and been a discrete single episode in 79%, discrete multiple episodes in 15%, and other in 5%. A weapon had been used in 33%, death had occurred in 30%, 55% had been physically injured (24% with permanent disability and 18% with disfigurement), 7%

had continuing threat, and 41% were claiming compensation.

The trauma preceding the PTSD had been personal in 51% and impersonal in 49%. It involved physical assault in 28%, road accident in 20%, witnessing a trauma in 15%, nonroad accident in 8%, sexual assault in 6%, being held hostage in 5%, bombing in 5%, combat in 3%, and miscellaneous in 11%. The onset of PTSD had been within a month in 89% and delayed by 6 months or more in 11%.

**Table 1. Baseline Demographic and Diagnostic Features for Trial Entrants**

Variable	Treatment, No. (%)				
	Exposure (n=23)	Cognitive (n=19)	Exposure and Cognitive (n=24)	Relaxation (n=21)	Total (N=87)
Male sex	14 (61)	13 (68)	18 (75)	11 (52)	56 (64)
Married/cohabiting	16 (69)	13 (68)	15 (63)	16 (76)	60 (69)
Employed	15 (65)	5 (26)	10 (42)	10 (48)	40 (46)
Age, y (mean±SD)	39±11	39±9	38±9	36±10	38±10
Current antidepressants	4 (17)	5 (26)	10 (42)	5 (24)	24 (28)
Duration of posttraumatic stress disorder, mo (mean±SD)	58±90	23±12	61±49	35±39	46±58
Current major depression	7 (30)*	12 (63)	15 (65)	8 (38)	42 (49)
Past major depression	11 (48)	6 (32)	13 (59)	7 (33)	37 (44)
Alcohol dependence/abuse	3 (13)	3 (16)	4 (18)	4 (19)	14 (17)

\* $P < .02$  compared with other treatment groups ( $\chi^2=9.9$ ,  $df=3$ ).

## IMPROVEMENT DURING TREATMENT AND FOLLOW-UP

### Within Treatments

Within E, C, and EC, improvement from pretreatment to posttreatment and from pretreatment to follow-up was highly significant on almost every measure, and that within R was significant on most measures. This pattern was already evident at week 6.

### Between-Treatment Comparisons

Between-treatment comparisons are on available data unless otherwise stated.

By ANCOVA, for E, C, and EC pooled compared with R (**Table 2** and **Table 3**), 11 of 12 primary measures and 17 of 24 secondary measures were significantly more improved from pretreatment to posttreatment; 6 of 12 and 6 of 24 from pretreatment to 1-month follow-up; and 8 of 12 and 8 of 24 from pretreatment to 3-month follow-up. For end-point imputation analyses on 12 primary measures only, E, C, and R combined improved significantly more than R from pretreatment to 1-month follow-up on 7 measures and from pretreatment to 3-month follow-up on 5 measures.

For pretreatment to 6-month follow-up scores, a separate ANCOVA compared E vs C; E was significantly better than C on 8 primary and 6 secondary measures, but none was significant on end-point imputation analyses of primary measures (**Figure**).

In LSD pairwise comparisons based on 1-way ANOVAs, for E vs C, E vs EC, and C vs EC, differences were few and inconsistent in direction as expected by chance when many comparisons are made. Compared with R, of the 12 primary measures and 24 secondary ones, 3 and 4 measures, respectively, were significantly more improved in the E group from pretreatment to posttreatment, 4 and 4 from pretreatment to 1-month follow-up, and 7 and 4 from pretreatment to 3-month follow-up; in the C group, 5 and 11 from pretreatment to posttreatment, 3 and 4 from pretreatment to 1-month follow-up, and 3 and 6 from pretreatment to 3-month follow-up; and in the EC group, 6 and 13 from pretreatment to posttreatment, 4

and 4 from pretreatment to 1-month follow-up, and 8 and 5 from pretreatment to 3-month follow-up.

When change was computed for weeks 0 to 11, there was almost no overlap of the confidence intervals for R with those of E, C, and EC, but almost complete overlap of the confidence intervals for E, C, and EC. The R group did consistently less well than E, C, and EC, while E, C, and EC had similar outcomes. Mean change scores (with 95% confidence intervals in parentheses) were as follows: for the IES: E, 28 (19-37); C, 25 (15-34); EC, 35 (24-49); and R, 13 (5-19); for the CAPS (3-cluster total): E, 30 (19-42); C, 36 (26-45); EC, 38 (26-50); and R, 14 (4-25); and for the Beck Depression Inventory: E, 13 (8-18); C, 17 (11-22); EC, 18 (13-23); and R, 7 (3-11).

Effect size was the mean change since week 0 divided by the SD of that change ( $\geq 1.0$  is usually regarded as clinically meaningful). The effect size in E, C, and EC was 1 to 2.5 from week 11 onward on most primary measures (Table 3) and higher still on some primary measures in E and EC at 3- and 6-month follow-up. Effect sizes in the R group were almost smaller than in E, C, and EC but were often 1.0 or greater.

Percentage of patients improved was analyzed for IES and CAPS (total of 3 clusters: reexperiencing, avoidance, and arousal) with a criterion of 2 SDs or more improvement since week 0<sup>34</sup> and for Global Improvement (self and assessor) with a criterion of markedly, much, or very much improved. The E, C, and EC groups consistently improved similarly and more than the R group. Percentage improvement at posttreatment evaluation was as follows: on the IES, 60% in the E group, 50% in the C group, 58% in the EC group, and 20% in the R group ( $\chi^2=8.1$ ,  $df=3$ ,  $P=.04$ ); on the CAPS, 47% to 53% in the E, C, and EC groups and 15% in the R group ( $\chi^2=7.5$ ,  $df=3$ ,  $P=.06$ ); on Global Improvement (self and assessor), 70% to 84% in the E, C, and EC groups and 50% to 55% in the R group ( $P$  not significant).

End-state function was determined according to the criteria<sup>35</sup> of a 50% drop in PTSD Symptoms Scale, a Beck Depression Inventory score of 7 or less, and a State-Trait Anxiety Inventory score of 35 or more, at week 11,

**Table 2. Pretreatment, Posttreatment, and Follow-up Values of Primary Measures for Treatment Completers\***

Measure, Time	Exposure (E)		Cognitive (C)		Exposure and Cognitive (EC)		Relaxation (R)		E+C+EC vs R, ANCOVA: $P < 0†$	
	No.	Mean±SD	No.	Mean±SD	No.	Mean±SD	No.	Mean±SD	Available Data	EPI
CAPS severity										
Pre	20	2.6±0.6	18	3.2±0.8	19	3.1±0.7	20	2.7±0.8	...	...
Post	20	1.5±1.4	19	1.6±1.2	20	2.0±1.2	18	1.7±1.3	.04	...
1 MFU	16	1.1±1.2	14	1.8±1.2	18	1.6±1.5	16	1.8±1.1	(.07)	.05
3 MFU	13	0.5±0.5	13	1.5±0.9	14	1.1±1.0	13	1.5±1.1	.04	(.09)
6 MFU	12	0.5±0.5	12	1.5±0.9	11	0.8±0.7	...	...	...	...
Work/social total (self)										
Pre	20	21.5±8.9	18	26.9±8.8	19	29.4±7.9	20	22.1±9.5	...	...
Post	20	11.8±12.3	18	14.3±10.0	19	13.2±12.1	20	17.5±11.6	.01	...
1 MFU	17	9.5±12.1	15	13.9±10.9	16	13.2±12.2	15	15.0±11.3	(.07)	(.07)
3 MFU	13	5.2±8.3	14	14.7±12.1	14	10.3±9.3	14	14.9±12.3	.04	(.08)
6 MFU	13	4.1±7.8	10	13.4±11.7	12	4.5±6.9	...	...	...	...
Global improvement (assessor)										
Mid	20	3.2±1.4	18	3.4±1.2	19	3.2±1.4	20	3.8±1.3	...	...
Post	20	2.4±1.5	17	2.6±1.4	19	2.2±1.1	20	3.4±1.8	.02	NS
1 MFU	16	2.1±1.4	14	2.4±1.2	19	2.5±1.6	16	3.1±1.7	NS	NS
3 MFU	12	1.5±0.7	13	2.4±1.0	14	1.9±1.5	13	2.8±1.5	.04	NS
6 MFU	12	1.3±0.6	12	2.3±1.1	11	1.2±0.6	...	...	...	...
Global improvement (self)										
Mid	19	2.5±1.5	18	2.6±1.1	19	2.6±1.2	18	2.9±1.5	...	...
Post	19	2.0±1.2	18	2.0±0.7	19	1.8±0.9	20	2.7±1.3	(.07)	...
1 MFU	17	1.9±1.5	15	1.9±0.8	17	1.8±0.9	15	2.3±0.8	NS	NS
3 MFU	13	1.4±0.7	14	1.9±0.9	14	1.6±0.8	13	2.3±1.1	(.06)	NS
6 MFU	13	1.2±0.4	11	1.8±0.6	12	1.1±0.3	...	...	...	...
Main problem‡ (assessor)										
Pre	20	6.6±1.1	18	7.4±0.8	19	7.2±0.8	20	6.7±0.8	...	...
Post	20	3.1±2.8	18	3.7±2.4	19	3.1±2.3	20	4.5±2.2	.002	...
1 MFU	16	2.5±2.6	14	3.2±2.2	17	3.0±2.2	16	4.2±2.3	.005	.002
3 MFU	12	1.5±1.2	13	2.7±1.9	13	2.1±1.8	13	3.8±2.3	.006	.007
6 MFU	12	1.1±1.4	12	2.8±1.8	11	1.1±0.9	...	...	...	...
Main problem‡ (self)										
Pre	20	6.8±1.3	18	6.7±1.1	19	7.3±0.9	20	7.0±1.1	...	...
Post	20	2.8±2.4	18	3.2±2.4	19	2.7±2.0	20	4.2±2.3	.03	...
1 MFU	16	2.4±2.4	15	2.3±2.1	17	3.2±2.9	15	4.1±2.2	.05	(.06)
3 MFU	13	1.5±1.3	14	2.6±2.3	13	1.8±1.5	14	3.9±2.4	.005	(.05)
6 MFU	13	1.3±1.3	11	2.7±2.1	12	1.1±1.1	...	...	...	...
Total of 4 goals‡ (assessor)										
Pre	20	27.7±2.6	18	30.1±2.0	19	29.8±2.1	20	29.0±2.9	...	...
Post	20	12.3±10.3	18	14.6±10.1	19	12.8±9.4	20	18.6±10.2	.01	...
1 MFU	16	9.5±10.3	14	12.4±9.2	19	11.9±9.2	16	17.1±10.1	.008	.01
3 MFU	12	6.1±5.7	13	10.8±7.2	13	7.9±8.4	13	15.3±9.9	.005	.03
6 MFU	12	4.2±5.4	12	11.4±8.2	11	3.4±2.8	...	...	...	...
Total of 4 goals‡ (self)										
Pre	20	28.1±2.9	18	29.4±2.1	19	30.0±2.5	20	29.9±2.1	...	...
Post	20	11.2±9.6	18	13.3±10.1	19	11.5±9.4	20	18.5±9.9	.02	...
1 MFU	16	9.7±9.7	15	11.5±8.6	16	11.2±9.0	15	17.1±10.2	.05	.04
3 MFU	13	6.0±7.1	14	11.4±8.2	13	6.8±7.1	14	15.7±10.6	.008	(.06)
6 MFU	13	4.8±5.6	11	9.3±7.5	12	2.3±2.1	...	...	...	...

\*ANCOVA indicates analysis of covariance; EPI, end-point imputed data; NS, not significant; CAPS, Clinician-Administered PTSD Scale; Pre, week 0; Post, week 11; MFU, months of follow-up; Mid, week 6; and ellipses, not applicable. Means of the remaining 4 primary measures are given in the Figure.

†Values in parentheses indicate nonsignificant trend.

‡As defined by Marks et al.<sup>29-33</sup>

10 patients (53%) in the E group, 6 (32%) in the C group, 6 (32%) in the EC group, and 3 (15%) in the R group were improved ( $\chi^2$  not significant). These figures are close to those of Foa and Meadows<sup>35</sup> for exposure (46%), self-instruction training (21%), and both combined (32%).

For PTSD criteria not met on CAPS, among the 77 treatment completers, CAPS 2 criteria for PTSD symptoms in the past week (not the Structured Clinical Interview for DSM-III-R criterion of a month) were met by

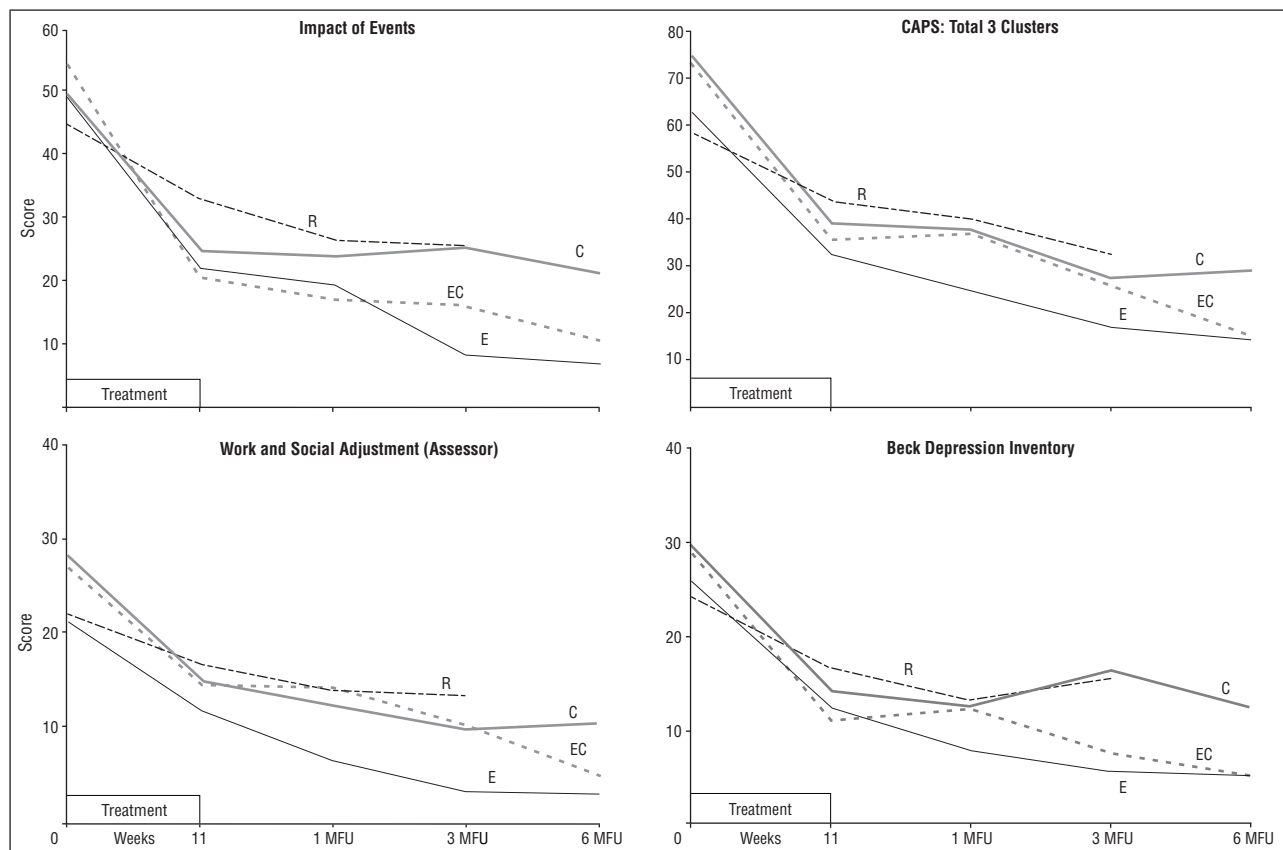
93% at week 0; by 36% (25% in the E group, 35% in the C group, 37% in the EC group, and 45% in the R group) at week 11; and by similar proportions at 1-month follow-up and 3-month follow-up ( $\chi^2$  not significant for all between-group comparisons).

Other variables: Almost all patients rated themselves as very satisfied or satisfied with treatment by week 11. Guilt and anger (CAPS) improved similarly in the E, C, and EC groups (ANCOVA). Within E, C, EC, and R

**Table 3. Effect Size on Primary Outcome Measures\***

Measure	Pretreatment to Posttreatment (n=77)				Pretreatment to 1-mo Follow-up (n=65)				Pretreatment to 3-mo Follow-up (n=54)				Pretreatment to 6-mo Follow-up (n=35)		
	E	C	EC	R	E	C	EC	R	E	C	EC	R	E	C	EC
IES	1.50	1.30	1.50	0.08	1.90	1.30	1.90	1.00	2.60	0.08	1.90	1.10	2.70	1.20	2.10
CAPS (total 3 clusters)	1.30	2.00	1.50	0.60	1.50	1.80	1.30	0.80	1.40	2.20	1.90	0.80	2.90	1.70	3.00
CAPS (severity)	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	2.00	2.00	2.00	1.00	2.00	2.00	2.00
BDI	1.20	1.70	1.80	0.07	1.80	1.30	1.10	1.00	1.50	1.00	1.30	1.00	1.60	1.30	1.50
Main problem (A)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.50	2.50	2.50	1.50	2.50	2.50	6.00
Main problem (S)	2.00	2.00	2.50	1.50	2.00	2.00	1.30	1.50	2.50	1.30	2.50	1.50	2.50	2.00	3.00
4 Goals total (A)	1.50	1.60	2.10	1.00	1.80	2.00	2.30	1.10	2.90	2.70	2.60	1.40	3.10	2.40	8.70
4 Goals total (S)	1.90	1.60	2.10	1.20	1.80	2.30	2.10	1.30	2.80	2.30	3.30	1.40	3.30	2.50	6.80
Work and social total (A)	1.10	1.30	1.40	0.07	1.80	1.30	1.30	0.07	2.50	1.80	1.60	0.09	2.10	1.30	3.70
Work and social total (S)	0.90	1.40	1.50	0.60	0.90	1.20	1.30	0.90	1.30	0.09	1.60	0.90	1.50	1.20	2.00

\*Effect size is the mean of the change score divided by the SD of the change score. E indicates exposure; C, cognitive; EC, exposure and cognitive; R, relaxation; IES, Impact of Events Scale; CAPS, Clinician-Administered PTSD Scale; BDI, Beck Depression Inventory; A, assessor-rated; and S, self-rated.



Mean change in each treatment group on the Impact of Events Scale, Clinician-Administered PTSD Scale (CAPS) 3-cluster, Beck Depression Inventory, and Work and Social Adjustment Scale (assessor). E indicates exposure; C, cognitive; EC, exposure and cognitive; R, relaxation; and MFU, months of follow-up. Significant differences or trends of E+C+EC vs R on analysis of covariance for available data (end-point imputation in parentheses) were as follows: Impact of Events Scale: pretreatment to posttreatment,  $P=.008$ ; pretreatment to 1 MFU,  $P=.08$  ( $P=.05$ ); pretreatment to 3 MFU,  $P=.05$ ; CAPS 3-cluster total: pretreatment to posttreatment,  $P=.005$ ; pretreatment to 1 MFU,  $P=.01$  ( $P=.02$ ); pretreatment to 3 MFU,  $P=.08$  ( $P=.07$ ); Work and Social Total Adjustment (assessor): pretreatment to posttreatment,  $P=.002$ ; pretreatment to 1 MFU,  $P=.006$  ( $P=.006$ ); pretreatment to 3 MFU,  $P=.005$  ( $P=.01$ ); and Beck Depression Inventory: pretreatment to posttreatment,  $P=.004$ ; pretreatment to 1 MFU, ( $P=.08$ ).

separately, improvement on Global Improvement (assessor and self), IES, and CAPS (3-cluster total) was similar ( $\chi^2$  not significant) regardless of therapist, patient sex, PTSD duration ( $<1$  vs  $\geq 1$  year), and the initiating trauma having been personal or impersonal.

### TREATMENT INTEGRITY

Of the 87 trial entrants, 74 (85%) consented to rating of audiotaped sessions by a "blind" behavioral-cognitive therapist outside the unit. From the 630 audiotaped ses-

sions available, 104 were selected by someone outside the study to randomly sample 2 of the 10 treatment sessions per patient from the E, C, and EC groups and 1 session per patient from the R group. The tapes selected concerned 34 E (17% of sessions available), 28 C (15%), 25 EC (13%), and 17 R (8%) sessions.

Integrity ratings were satisfactory. Treatment condition was rated correctly on every tape. On a scale of 0 to 8 (0, unacceptable; 8, excellent), mean ratings were similar across treatment conditions and therapists for *non-specific* factors (collaboration, interpersonal behavior, homework setting, global acceptability) (mean $\pm$ SD, 5.5 $\pm$ 0.7; median, 6; range, 4-7) and for factors *specific* to each treatment (whether an agenda was negotiated, prolonged exposure and stopping avoidance in E and EC, cognitive methods in C and EC, no exposure or cognitive instructions in C or E, and in R, global acceptability) (mean $\pm$ SD, 5.5 $\pm$ 0.9; median, 6; range, 3-7).

### HOMEWORK COMPLIANCE

The therapist rated this from patients' daily homework diaries, based on the percentage completion of the forthcoming week's homework negotiated at the end of each session.

Mean ( $\pm$ SD) percentage compliance was as follows: all 77 patients, 63% $\pm$ 30%; E, 65% $\pm$ 29%; C, 43% $\pm$ 28%; EC, 75% $\pm$ 29%; and R, 69% $\pm$ 28%. Lower compliance for C ( $\chi^2=10.3$ ,  $df=1$ ,  $P=.02$ ) could be artifactual, as challenging cognitions was harder to rate than time spent in E and R tasks. Better ( $\geq 50\%$ ) compliance was associated with more week 11 improvement on Global Improvement (assessor) ( $n=77$ ,  $\chi^2=5.73$ ,  $df=1$ ,  $P=.02$ ;  $r=0.27$ ,  $P=.02$ ).

### ASSESSOR BLINDNESS

At weeks 6 and 11, after rating the patient, the assessor tried to guess the treatment condition. Correctness of guesses did not differ significantly from that expected by chance.

### REFUSERS, TREATMENT DROPOUTS, AND NONCOMPLETERS OF 6-MONTH FOLLOW-UP

The 22 refusers had similar age, sex, and PTSD duration to the 87 trial entrants. The 10 dropouts who did not reach week 11 were compared with the 77 treatment completers on 32 demographic, trauma, and baseline severity variables; they were similar on all variables except for having had more past psychological treatment and slightly more severe CAPS score at baseline.

The 25 noncompleters of 6-month follow-up of the 77 treatment completers came in similar numbers from the E, C, EC, and R groups. On the 32 variables at week 0, follow-up noncompleters had been similar to completer counterparts in the C, EC, and R groups, but in E they had been significantly more ill on 8 primary measures. At week 11, follow-up noncompleters in the E and EC groups had been significantly less improved than completer counterparts on almost all 12 primary measures. A slight superiority of E and EC over C at 6-month follow-up must therefore be discounted.

## STRENGTHS AND LIMITATIONS OF THE STUDY

The study met almost all the gold standard criteria of Foa and Meadows.<sup>35</sup> Patients were selected for having *DSM-III-R* PTSD for 6 months or longer, had been diagnosed by the Structured Clinical Interview for *DSM-III-R* by trained evaluators, were randomized to each treatment and therapist, and had standardized treatment by trained supervised therapists using detailed manuals. Each therapist gave all 4 treatments in similar proportions. Treatments were delivered as planned, judged by blind independent ratings of their integrity. Treatment adherence was sound. Assessors were kept unaware of treatment assignment. Standard reliable and valid measures of PTSD and other symptoms and disability were used. Follow-up was up to 6 months after treatment.

There were 3 further criteria of validity. Assessors were found to be truly unaware of treatment assignment. Outcome was similar regardless of (1) analytic method (ANCOVA, ANOVA, LSD pairwise comparisons for treatment completers and intent-to-treat sample, confidence intervals, effect size, percentage improvement, and end-state function); yet more analytic methods seem unlikely to affect conclusions, (2) rater (assessor unaware of treatment assignment, self), (3) measure (primary, secondary), (4) occasion (weeks 6 to 36), (5) therapist, (6) patient gender, (7) inducing trauma having been personal or impersonal, and (8) PTSD duration. Improvement as measured by end-state function was similar to that found by Foa and Meadows.<sup>35</sup>

The trial had several limitations. Despite randomization, at trial entry exposure (E) and relaxation (R), patients were less severe on some baseline measures than cognitive restructuring (C) and combined treatment (EC) patients. Second, in the E and EC groups, but not in the C and R groups, noncompleters of follow-up had been less well when last seen than completers at the same point. The slight superiority of E over C at 6-month follow-up thus had to be discounted.

Third, the trial used many measures to answer several questions, thus increasing the chance of significant differences appearing randomly across groups, yet E, C, and EC were consistently superior to R with few differences among them.

### MAIN OUTCOMES

Compared with past RCTs using exposure or cognitive treatment, the present patients' PTSD severity, comorbid depression, and improvement were at least as great.<sup>36</sup> The use of E alone, C alone, and EC each produced similar marked improvement, which was usually superior to that from R. Outcomes contrary to team expectations were that E did no better than C and that R improved PTSD somewhat (more than agoraphobia<sup>30</sup> and obsessive-compulsive disorder<sup>31,32</sup>).

Anger and guilt improved as anxiety did. Patient satisfaction was similar across treatments. Exposure was easier to give than C and may be done as self-care.<sup>37</sup> Therapists became distressed on hearing patients' harrowing

experiences, and also found EC harder to do than E or C alone.

Present cell sizes were unusually large for RCTs of PTSD. More between-treatment differences might emerge with a far larger sample. The absence of consistent trends to these, however, suggests that this might be a search for statistical more than clinical significance.

Our results fit those of other RCTs in which E alone and C alone led to similar improvement in obsessive-compulsive disorder<sup>38</sup> and in panic/agoraphobia,<sup>39</sup> E improved PTSD similarly to C plus nonexposure methods<sup>11</sup> and C plus E (Patricia Resick, PhD, oral and written communication, July 4, 1996) and C alone improved nightmares.<sup>40</sup>

Despite E and C each being effective alone, combining them yielded no clear enhancement. Perhaps 105-minute EC sessions were too short to allow patients to learn both E and C properly. Perhaps, too, components common to E and to C (minimal exposure, problem solving) helped patients so that duplicating them in combined treatment conferred no added value. More enhancement might come from adding antidepressant medication to E or C, especially when mood is low.

### THERAPEUTIC MECHANISMS

Was the similar marked improvement after E and after C caused by shared and/or different mechanisms? Each alone turns out to be sufficient but not necessary to improve PTSD, obsessive-compulsive disorder, and panic/agoraphobia. Improving behavior can help feelings and thoughts, and vice versa. Effective common components were unlikely to have been therapist contact, doing homework, or keeping diaries, as R contained those yet resulted in less improvement than E and C.

A view that exposure acts merely by cognitive restructuring faces formidable objections. In vertebrates and invertebrates,<sup>41</sup> exposure gradually reduces defensive responses to cues to which the subject is exposed; this habituation depends on the dose of exposure. Continuous stimulation in neurons and immune and endocrine cells tends to dampen responses, and intermittent stimulation tends to increase them. Habituation is an ancient mechanism that humans can harness to reduce emotional responses.

It is equally unlikely that cognitive restructuring acts by habituating through prolonged exposure. Patients in the C group had no prolonged exposure in sessions and no instructions to engage in it as homework; this was confirmed in blind ratings of treatment integrity. Did patients in the C group improve from minimal exposure during cognitive instruction? If so, this was not habituation from prolonged exposure.

### TOWARD A SYNTHESIS

Emotions can be bridled in various ways. Anxiety and depressive disorders improve with several psychological treatments and medications. Depression improved with antidepressant medications, cognitive therapy, interpersonal therapy, behavioral activation,<sup>42</sup> problem solving,<sup>43</sup> and pastoral counseling.<sup>44</sup> Many, but not all, treat-

ments are effective. Relaxation is usually less potent than exposure or cognitive restructuring in anxiety disorders. Seeing a physician was less helpful than exposure for anxiety disorders<sup>33</sup> or problem solving for depression.<sup>43</sup> Pill placebo is less potent than many medications for anxiety and depressive disorders.

Such diverse findings can be integrated by viewing emotions as response syndromes,<sup>45,46</sup> loosely linked reactions of many physiological, behavioral, and cognitive kinds. An emotion can be reduced by action on certain strands in its skein of responses. Attenuating one strand can then weaken others. Weakening of some rather than other strands may have more consequences. Some treatments may act on several strands simultaneously.

Exposure gradually alters behavior, physiology, and cognitions by habituation (eg, cognitive habituation from mere exposure by semantic satiation). Cognitive restructuring might distance sufferers from strident feelings and facilitate dealing with them by changing perspectives; it may include habituation via behavioral experiments including exposure, but this is not essential. Relaxation might be a way to reduce arousal and then other problems, though this seems inefficient (relaxation now needs testing against another attention placebo). Antidepressant medication relieves low mood, which often exacerbates anxiety disorders. Each treatment might act on particular emotional strands, which in turn help unravel other aspects of disease.

Both E and C emphasized step-by-step definition of problems and of goals to solve those problems, albeit by different means. Many problems are digestible bit by bit. The digestive mechanisms, however, may vary. A general instruction to reduce arousal by relaxing different muscle groups bit by bit helped patients less than focused instructions to tackle aspects of the trauma directly by exposure or cognitive restructuring. Unfocused medication, however, may also help.

Both E and C teach patients to control feelings. Animals became more disturbed when aversive events were uncontrollable and unpredictable, and experiencing mastery reduced subsequent fear.<sup>41,47,48</sup> Occasionally, reducing fear by exposure boosts wider self-confidence. Conversely, a surge of courage for any reason can prompt people to overcome phobias by doing exposure. More research is needed into defining which conditions toughen rather than sensitize and produce reliable long-term stress immunization.

In conclusion, up to 6-month follow-up exposure and cognitive restructuring each yielded marked broad-spectrum improvement in chronic severe PTSD, more than did relaxation, and did not show detectably better outcome when combined.

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