Early versus delayed imaginal exposure for the treatment of posttraumatic stress disorder following accidental upper extremity injury

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Abstract

Background The consequences following work-related injuries are far reaching, which are in part due to unrecognized and untreated posttraumatic stress disorder (PTSD). Imaginal exposure is a frequently used cognitive behavioral approach for the treatment of PTSD. This study examined the impact of early versus delayed treatment with imaginal exposure on amelioration of PTSD symptomatology in individuals who suffered upper extremity injuries.

Methods Sixty individuals who suffered severe work-related injuries received standard, non-randomly assigned psychological treatment for PTSD (e.g., prolonged imaginal exposure) either early (30–60 days) or delayed (greater than 120 days) following severe work-related upper extremity injury. Nine measures of various components of PTSD symptomatology were administered at onset of treatment, end of treatment, and at 6-month follow-up evaluations.

Results Patients showed significant treatment outcomes at all three measurement intervals in both the early and delayed groups demonstrating that Prolonged Imaginal Exposure is an appropriate treatment for persons diagnosed with PTSD.

In addition, there was no difference in return to work status between the early and the delayed treatment groups. However, the early treatment group required significantly fewer treatment sessions than the delayed treatment group.

Conclusions Results supported the utility of imaginal exposure and the need for early assessment and referral for those diagnosed with PTSD following upper extremity injuries.

Keywords Posttraumatic stress disorder · Upper extremity injuries · Psychology · Imaginal exposure · Time of intervention

Introduction

According to the 1997–1999 National Health Interview Survey, 5.5 million medically treated injuries occurred in the workplace [28]. These figures do not reflect the impact of any short- or long-term psychological sequelae including but not limited to depression, anxiety, phobias, and post-traumatic stress disorder (PTSD) symptomatology [26]. Initial treatment of traumatically injured patients seldom includes screening for trauma-related psychological symptoms. This can result in delays in multiple areas including: symptom identification, implementation of useful treatments, and return to work. A combination of these factors can contribute to financial losses for injured individuals, their families, employers, and insurance companies.

CBT Treatment of Industrial Accident Victims

PTSD has been found to frequently develop as a result of physical injuries in work-related accidents [2, 5, 6, 11]. In a study by Grunert et al. [15], a large percentage (25–51 %) of hand-injured patients continued to suffer symptoms associated with PTSD as long as 6 months following their

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industrial injuries. Frequently reported symptoms included recurring visual flashbacks, nightmares, anxiety, fear of re-injury, depression, disgust (e.g., over the physical appearance of a disfigured hand), irritability, social withdrawal secondary to disfigurement, and avoidance of stimuli associated with their accidents. Type, duration, and extent of injury have been reported to significantly correlate with PTSD symptom severity following industrial accidents [1, 24, 34] as well as poor premorbid adjustment [11]. Indeed, the psychological sequelae of industrial injuries can often be as debilitating as the physical consequences of these accidents. Empirically supported psychological treatment for PTSD following work-related injuries, therefore, is essential for the complete rehabilitation of the injured worker [17].

Research to date has consistently found cognitive-behavioral therapy including prolonged imaginal exposure to be valuable for treating the symptoms of PTSD [8–10, 23, 27]. Grunert and colleagues have a long established and published program of research to date regarding the effect of work-related injury on individuals. Their studies have focused on prognostic indicators impacting return to work including types of flashbacks, impact of attributions, litigation, avoidance, the impact of cosmesis, imaginal exposure, and the effectiveness of gradual return to work programs [11–16, 18, 19].

At present, no research has addressed the timing of interventions for the work-injured population. Considering the extensive physical, financial, and emotional costs to patients, families, employers, and insurance providers, it seems relevant to engage in research to determine ways to limit these high costs and reduce patient suffering. The purpose of this study was to examine the differential clinical outcome of patients who received treatment early (30–60 days) or delayed (greater than 120 days) as part of their normal psychological treatment (e.g., prolonged imaginal exposure) for PTSD following severe work-related upper extremity injury. Return to work patterns were also examined across patients. The following hypotheses were examined:

1. All participants show positive treatment outcomes from prolonged imaginal exposure on symptoms of intrusion and avoidance, depression, anxiety, concentration and distractibility, and level of distress.
2. Participants in the early treatment group show more favorable return to work outcomes than participants in the delayed treatment group. Return to work was defined as:
 - Return to work—same employer
 - Return to work—different employer
 - No return to work
3. The number of treatment sessions is fewer for the early treatment group versus the delayed treatment group as measured by stabilization of subjective distress ratings (SUDS).

Materials and Methods

Participants

The patients for this study included 60 persons seen for psychological treatment after severe, work-related upper extremity injuries (see Table 1). Types of injuries included digit amputations, upper extremity amputations, crush injuries, and burns among others. Mechanisms of injury included explosions, punch presses, saws, and electrocutions. Participants were consecutively treated patients seen by the clinic; all participants sustained work-related injuries and were treated as part of a Worker Compensation claim. Non-English speaking patients were excluded from study participation. All patients received individual treatment between January 1994 and July 1998 by the second author following referral by their physician and met DSM-IV [7] criteria for PTSD at the time of their pretreatment evaluation. As part of a clinical case series, the sample was constituted of all of the patients treated in the clinic between January 1994 and July 1998; this study was a retrospective chart review of the treatment provided in a naturalistic clinical setting. All data were de-identified. This study was approved by the Institutional Review Board at the Medical College of Wisconsin.

The psychological treatment of patients occurred at a southeastern Wisconsin area medical center Department of

Table 1 Demographic variables of the participants

	Early	Delayed
Ethnicity (<i>n</i>)		
African American	10	6
Asian American	0	1
Caucasian	14	18
Hispanic	6	5
Gender (<i>n</i>)		
Male	21	23
Female	9	7
Age		
Range	20–60	19–56
Mean	32.6	34.0
Type of injury (<i>n</i>)		
Finger amputation	19	11
Hand crush	4	5
Hand crush/burn	1	0
Degloving	1	0
Forearm amputation	3	4
Hand nerve laceration	1	2
Upper extremity burn	1	6
Hand amputation	0	2

Re-plants completed whenever medically feasible

Plastic and Reconstructive Surgery. Physician referral patterns determined placement in either an early or a delayed treatment group. Delay was defined as the time from injury to the time of referral. The early group consisted of 30 patients referred by the medical center surgeons between 30 and 60 days post-injury. They were screened for PTSD sequelae (standard procedure at this facility) and were then referred early for psychological intervention. The delayed group consisted of 30 patients referred 120 days or more post-injury by physicians outside the facility. Patients were not randomly assigned. All patients in the study had the support of Worker's Compensation carriers to obtain treatment. As soon as patients reported symptoms, they were referred for treatment. During initial psychological assessment, all patients reported experiencing symptoms from the time of injury on duplicating earlier research findings [15].

Instruments

The *Impact of Event Scale* (IES) is a 15-item, self-report questionnaire that measures the frequency of psychological responses to stressful life events occurring within 7 days prior to administration [20]. The IES yields three scores: an Intrusion subscale score, an Avoidance subscale score, and a Total Score. The IES can be a useful instrument for initial assessment of accident victims and for the monitoring of progress throughout treatment [4].

The *Beck Depression Inventory* (BDI) is a 21-item self-report inventory that assesses the intensity of depressive symptoms and attitudes within the past week [3]. The BDI may be very useful in the assessment of accident victims as it can be administered multiple times over the course of treatment [4].

The *State-Trait Anxiety Inventory* (STAI) includes self-report scales for measuring state and trait anxiety. The S-Anxiety scale asks the patient to rate how they feel "right now." The S-Anxiety scale consists of 20 statements on a single-page form. For the purpose of this study, the State scale was used alone [31].

Subjective Units of Distress (SUDS) is a self-report measure indicating the degree of discomfort or distress that a patient is currently experiencing. A rating of "0" indicates the patient is feeling no discomfort whatsoever. A rating of "10" indicates the patient is feeling extremely uncomfortable. The SUDS levels inform the clinician of the patient's subjective discomfort experience at any given point in time during the exposure [35]. This instrument has been widely used by clinicians during imaginal exposure treatments and PTSD research [21, 29, 30].

The *Digit Span* subtest of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) was used to measure a patient's susceptibility to anxiety, distractibility, and concentration difficulties while engaged in a mental activity that requires

freedom from internal distractibility. Test-retest reliability is 0.83 [22].

The instruments in this study were used to assess clinical progress throughout treatment. Psychological evaluations including the BDI, State-Anxiety Scale, WAIS-R Digit Span Subtest, and the IES were administered at (1) initial intake, (2) end of treatment, and (3) 6-months follow-up. SUDS ratings were obtained throughout treatment; however, only probes from the initial evaluation, the end of treatment evaluation, and the 6-month follow-up were used in the statistical analysis for this study.

Treatment

The intervention for all patients consisted of prolonged imaginal exposure sessions lasting between 60 and 75 min. Patients were trained in relaxation techniques and then asked to close their eyes, recall the day of their accident, and begin visualizing and verbalizing aloud the entire traumatic event in detail and in the present tense, as though it were happening now. Throughout the exposure sessions, patients were asked to describe all aspects of their trauma memory including peri-traumatic thoughts, feelings, visualizations, sounds, smells, physical sensation, and others' responses. The trauma memory was experienced three to five times during each exposure session. SUDS levels were obtained at the following four discreet points during the imaginal reliving: (1) while preparing for going to work on the day of the accident, (2) upon arrival at work until just before the traumatic event occurred, (3) during the traumatic event itself, and (4) during the "rescue" by co-workers and medical personnel. A period of reprocessing followed each exposure session to facilitate the reinterpretation and integration of the traumatic material. An audio tape of each session was given to the patients for daily listening. Treatment was terminated following clinical decision based on the stabilization of SUDS ratings or lack of decrease in SUDS ratings. The decision to stop was made when patients' SUDS ratings failed to decrease, if the ability to image was lacking, or if patients exhibited extreme avoidant behaviors such as opening their eyes or leaving the image and discussing other issues. Seven of the 60 patients did not obtain remission of symptoms. No patient participated in more than 23 exposure sessions.

Analysis

A doubly multivariate, repeated measures design was used (using an SPSS data package) to examine the hypotheses, compare the recovery trajectories of the early versus delayed treatment, and control the experiment-wise error rate. The repeated measures variable was time (initial intake, end of treatment, 6-month follow-up), and the between-subjects

variable was timing of PTSD treatment (early referral versus delayed referral). The multiple dependent variables were WAIS-R digit span, IES avoidance, IES intrusion, BDI, STAI-anxiety, and SUDS 1–4. The effect over time was then compared between groups across all dependent variables [32].

Results

See Table 1 for demographic information about patients in the early and delayed treatment groups. The results of the doubly multivariate analysis of variance are presented in Table 2. With the use of Pillai's Trace criterion, there was a statistically significant difference in PTSD symptomatology over the three assessment time points for all outcome measures (see Table 2). Linear contrasts were performed to examine where significant differences occurred. Results from this analysis (see Table 3) demonstrated that patients showed improvement in symptoms associated with PTSD (i.e., increase in attention, decrease in avoidance and intrusions, decrease in depression and anxiety, decreased subjective distress throughout exposure). Specifically, from the intake assessment to the end of treatment assessment, there was symptom improvement, with further improvement in symptoms from the end of treatment to the 6-month follow-up time point. This indicated that prolonged imaginal exposure was valuable in remission of symptoms following treatment, with this finding continuing in a recovery trajectory after treatment ended.

A significant interaction between time of intervention (early vs. delayed) and time of assessment (initial intake, end of treatment, vs. 6-month follow-up) was found (see Table 2). Linear contrasts were performed to examine significant mean differences. Results indicated that time of intervention interacted with time of assessment for the intrusion, $F(1,59)=7.02$, $p<.05$ and SUDS 3, $F(1,59)=5.19$, $p<.05$. Specifically, the decrease in intrusive symptoms from initial intake ($M=23.43$, $SD=3.16$) to the end of treatment ($M=10.30$, $SD=5.26$) was greater for patients who received early treatment for PTSD rather than delayed treatment ($M=23.17$, $SD=3.34$; $M=13.30$, $SD=6.28$, respectively; see Table 4 for means and standard deviations).

For subjective distress at the point of the exposure session where the patient is reliving the traumatic event itself (SUDS 3), the trend of decreasing PTSD symptoms from the end of treatment to the 6-month follow-up assessment was greater for those who received early treatment for PTSD ($M=3.83$, $SD=2.60$ and $M=2.60$, $SD=2.94$, respectively) than for those who received delayed treatment ($M=4.37$, $SD=3.32$ and $M=3.73$, $SD=3.60$, respectively; see Table 4 for means and standard deviations). Although patients in the early treatment group saw clinical gains faster, there was no significant effect of time of intervention (early vs. delayed) on PTSD symptoms (see Table 2); all patients showed improvement in PTSD symptomatology regardless of whether intervention was provided soon after the trauma or after a delay.

To investigate the return to work hypotheses, a Pearson chi-square test for independence was performed. The patients did not differ significantly in return to work outcomes (return to work–same employer, return to work–different employer, not return to work), $\chi^2(2, N=60)=1.98$, $p=.37$, such that a similar proportion of patients experienced each outcome across early ($N=27$ of 30) versus delayed ($N=23$ of 30) treatment.

Finally, an independent samples t test was utilized to investigate whether the number of treatment sessions differed depending on whether the patient received early or delayed prolonged imaginal exposure for PTSD. Results indicated that there was a significant difference in the number of sessions required for treatment between those who received early versus delayed treatment $t(58)=4.26$, $p<.001$; patients who were treated early with prolonged imaginal exposure required fewer treatment sessions ($M=9.20$, $SD=3.79$) than patients who were treated after a delay ($M=14.10$, $SD=5.04$).

Discussion

The results of this study demonstrate the usefulness of treating PTSD in a work-related, traumatically hand-injured population with prolonged imaginal exposure. These results extend previous research by Foa and Kozak [8] on PTSD treatment to the hand-injured population. Time of treatment initiation was not found to significantly diminish

Table 2 MANOVA results for time of intervention (early vs. delayed), time of assessment (intake, end of treatment, 6 month follow-up), and the interaction between time of intervention and assessment

Effect	Type of effect	<i>F</i> value	<i>p</i> value
Time of intervention (early vs. delayed)	Between subjects	$F(9,50)=1.19$	.320
Time of assessment (intake, end of treatment, 6 month follow-up)	Within subjects	$F(18,41)=29.41$	<.001
Interaction (time of intervention $\times$ time of assessment)		$F(18,41)=1.75$	<.001

Criterion used: Pillai's trace

Table 3 Within-subjects contrasts across assessment time for the nine outcome measures

Dependent measures	Assessment time	<i>MS</i>	<i>F</i>
WAIS-R Digit Span	Intake assessment vs. end of treatment	56.07	55.43**
	End of treatment vs. 6-month follow-up	81.67	40.74**
IES-Avoidance	Intake assessment vs. end of treatment	4,200.07	192.99**
	End of treatment vs. 6-month follow-up	646.82	105.37**
IES-Intrusion	Intake assessment vs. end of treatment	7,935.00	347.89**
	End of treatment vs. 6-month follow-up	735.00	117.85**
BDI	Intake assessment vs. end of treatment	4,558.82	185.57**
	End of treatment vs. 6-month follow-up	1,450.42	114.03**
STAI-S Anxiety	Intake assessment vs. end of treatment	16,269.07	175.44**
	End of treatment vs. 6-month follow-up	5,434.02	147.82**
SUDS 1	Intake assessment vs. end of treatment	2,184.07	296.43**
	End of treatment vs. 6-month follow-up	2.82	8.10 *
SUDS 2	Intake assessment vs. end of treatment	2,587.27	285.11**
	End of treatment vs. 6-month follow-up	7.35	14.58**
SUDS 3	Intake assessment vs. end of treatment	2,053.35	237.79**
	End of treatment vs. 6-month follow-up	52.27	50.25**
SUDS 4	Intake assessment vs. end of treatment	2,680.02	271.67**
	End of treatment vs. 6-month follow-up	6.02	16.75**

* $p < .01$; ** $p < .001$

treatment outcomes in terms of PTSD symptom reduction. The delayed treatment group, however, did require significantly more treatment sessions in order to attain symptom reduction. This clearly has social ramifications in terms of human suffering and economic costs. Additionally, the patients in this study benefitted from early intervention despite the uncertainty experienced by many of them as to the eventual outcomes of their medical care. Most of them had only minimal functional recovery when their psychological intervention commenced. Incorporating early intervention with these patients diminished not only their own psychological distress but also that of their family and social support system

A second important finding of this study is that prolonged imaginal exposure not only reduced PTSD symptomatology during treatment but also resulted in these benefits being maintained or even enhanced following treatment. This improvement was most pronounced for the SUDS rating at scene 3 (the accident itself). Considering that scene 3 was the most distressing of the four imaginal scenes, continuing improvement may have been due simply to more rapid habituation to the material contained in scenes 1, 2, and 4. Another possible explanation for these findings may be that patients acquired and utilized skills learned in the prolonged imaginal exposure procedures that facilitated

Table 4 Means and standard deviation of dependent variables by time of intervention (early vs. delayed) and time of intervention (initial, end of treatment, 6-month follow-up)

Measure	Initial evaluation				End of treatment				6-month follow-up			
	Early		Delayed		Early		Delayed		Early		Delayed	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
WAIS-R Digit Span	7.00	2.17	7.47	2.16	8.20	2.14	8.20	2.16	9.40	2.24	9.33	2.37
IES Avoidance	23.10	2.89	22.17	3.45	13.90	5.43	14.63	5.88	10.07	6.21	11.90	6.82
IES Intrusion	23.43	3.16	23.17	3.34	10.30	5.27	13.30	6.28	7.03	6.18	9.57	7.18
BDI Depression	19.20	6.07	22.53	7.17	10.33	5.26	13.97	7.60	5.63	5.53	8.83	6.37
STAI State	59.70	13.35	61.47	12.97	41.17	13.54	47.07	14.79	32.87	14.70	36.33	13.83
SUDS: scene 1	8.07	2.36	8.43	1.96	1.93	2.29	2.50	2.73	1.73	2.08	2.27	2.46
SUDS: scene 2	9.23	1.10	9.57	0.97	2.47	2.70	3.20	3.57	2.03	2.70	2.93	3.59
SUDS: scene 3	9.97	0.18	9.93	0.37	3.83	2.60	4.37	3.32	2.60	2.94	3.73	3.60
SUDS: scene 4	9.50	1.01	9.63	1.07	2.43	2.78	3.33	3.57	2.17	2.82	2.97	3.49

continued symptom abatement even to the most distressing moments of their traumatic event after the end of treatment.

Following treatment, the majority of patients returned to work. In this study, 83 % returned to work by the end of the 6-month follow-up, with those who did not return to work doing so primarily due to psychological rather than physical reasons. For the general population, only 25 % of persons diagnosed with PTSD return to work [25]. Returning to the work site may have afforded work participants further opportunity for desensitization by in vivo exposure at the work environment. Return to work is a symbol of emotional and physical recovery for the work-related traumatically injured population. Those who were unable to return to work reported little to no reduction in PTSD symptomatology across all measures.

In light of the findings of this study, early identification and treatment of psychological symptoms accompanying upper extremity injuries are clinically warranted. The authors have developed a brief screening instrument that can be administered by health care providers as part of initial evaluation [33]. This screening can facilitate the identification of those patients who would benefit from early psychological intervention. We have found these screening items to be helpful in this process.

Screening should include such questions as:

1. Have you experienced any vivid thoughts about the accident/injury? (If the answer is yes, expand to ask about recurring flashbacks and nightmares).
2. What do you believe is the cause of your accident/injury? (This attributional component will alert you to feelings of being out of control. Individuals who are left feeling vulnerable and open to another accident/injury at any moment have a much greater likelihood of developing PTSD).
3. Are you able to go back to the place/location where the accident/injury occurred? Are you able to go back to doing what activity you were engaged in at the time of the accident/injury? (This signals avoidant behavior, and although it is not predictive of PTSD, it is predictive of the severity of the psychological distress).
4. What do you think could be done to prevent the accident/injury? (This again taps into attributional and self-control issues).
5. Screen for other symptoms of stress:
 - (a) Problems with concentration/motivation
 - (b) Sleep disturbances
 - (c) Hypervigilance/increased startle response
 - (d) Increased irritability
 - (e) Changes in mood
 - (f) Changes in appetite

Early screening and treatment serve to reduce patient suffering. Some patients may spontaneously improve

without treatment; however, we have no effective means of identifying this sample of patients. Early intervention also reduces the cost of care as fewer sessions of treatment are required. While the onset of treatment does not seem to affect successful return to work, late treatment does result in a longer period of psychological distress, temporary disability in the Worker's Compensation system, and more pervasive, intrusive symptoms related to the injury. With this in mind, we recommend early treatment for all patients experiencing the complex of symptoms assessed by this study. Future research randomizing the assignment of patients to early versus delayed treatment may further clarify these outcomes.

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