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ORIGINAL ARTICLE

Eye movement desensitization and reprocessing for treating psychological disturbances in Taiwanese adolescents who experienced Typhoon Morakot

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Abstract In this case–control study, we aimed to assess the intervention effects of four-session eye movement desensitization and reprocessing (EMDR) on reducing the severity of disaster-related anxiety, general anxiety, and depressive symptoms in Taiwanese adolescents who experienced Typhoon Morakot. A total of 83 adolescents with posttraumatic stress disorder related to Typhoon Morakot, major depressive disorder, or current moderate or high suicide risk after experiencing Typhoon Morakot were allocated to a four-session course of EMDR ($N = 41$) or to treatment as usual (TAU; $N = 42$). A multivariate analysis of covariance was performed to examine the effects of EMDR in reducing the severity of disaster-related anxiety, general anxiety, and depressive symptoms in adolescents by using preintervention severity values as covariates. The multivariate analysis of covariance results indicated that the EMDR group exhibited significantly lower preintervention severity values of general anxiety and depression than did the TAU group. In addition, the preintervention severity value of disaster-related anxiety in the EMDR group was lower than that in the TAU group ($p = 0.05$). The results of this study support that EMDR could alleviate general anxiety and depressive symptoms and reduce disaster-related anxiety in adolescents experiencing major traumatic disasters.

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Introduction

Major traumatic disasters have frequently occurred worldwide in recent years. Every year, millions of adolescents and children experience a traumatic disaster. Previous studies have found that exposure to a disaster has a tremendous impact on the development of psychiatric disorders. For example, Kristensen et al. [1] reported that the rate of newly developed mental disorders was twice as high in people directly exposed to a disaster than in those not directly exposed. In addition, research has found that the prevalence rate of trauma-related posttraumatic stress disorder (PTSD) is approximately 10–20%, that of major depressive disorder (MDD) is > 20%, and that of suicide risk is > 10% [2–4]. However, if trauma-related psychiatric symptoms remain untreated, symptoms would persist over a 1-year period following mass trauma [3] and cause severe damage to the mental health of adolescents [5]. Thus, adequate, timely intervention is necessary to improve the mental health of adolescents experiencing major natural disasters.

On August 7, 2009, Typhoon Morakot made landfall in Taiwan. Most areas of Southern Taiwan recorded heavy daily rainfall, peaking at 2777 mm (109.3 in). This large amount of rain caused severe flooding throughout Southern Taiwan and triggered enormous mudslides in mountainous areas, causing the deadliest typhoon-related disaster in Taiwan in 50 years. Because of the mudslides, nearly all the inhabitants of steep mountainous areas had a life-threatening experience, and most of their homes were buried by several meters of mud. The Center for Disaster Medicine at Kaohsiung Medical University, Kaohsiung, Taiwan organized a team to provide medical services to people who experienced Typhoon Morakot. Sheehan et al. [6] conducted diagnostic interviews 3 months after the typhoon using the Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID), based on the criteria of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR)* [7]. They interviewed 271 adolescents in three junior high schools in the mountainous regions of Southern Taiwan that were the worst affected by Typhoon Morakot. Subsequent studies have described the results of these diagnostic interviews [8–10]. In summary, 70 (25.8%) adolescents had PTSD related to Typhoon Morakot, 50 (18.5%) had MDD, and 36 (13.3%) had current moderate or high suicide risk, based on the MINI-KID (total score on the suicidality module, ≥ 9). A total of 97 (34.7%) adolescents had a significant psychological disturbance defined by having PTSD, MDD, or current moderate or high suicide risk. These results have indicated that mental health professionals must provide intervention for the adolescents who experienced Typhoon Morakot-associated mudslides.

Although cognitive-behavioral therapy (CBT) is a frequently used therapeutic approach in treating adolescents with PTSD or depression [11,12], whether other psychotherapeutic approaches are equally effective in treating adolescents with PTSD or depression remains unclear. Eye movement desensitization and reprocessing (EMDR) has been proven to be potentially therapeutic for PTSD and has been extended to the treatment of depression in recent

years [11–13]. EMDR can rapidly desensitize traumatic experiences and reduce symptoms within fewer sessions than CBT can [13]. Because of efficacious desensitization techniques, EMDR enables managing numerous cases, has a low dropout rate, and produces a prolonged therapeutic effect [14]. The level of emotional processing in adolescents with traumatic memory significantly increased after therapy [15]. A recent meta-analysis showed that EMDR revealed a medium-large effect associated with reducing symptoms of PTSD [16]. In addition, studies have shown that EMDR is superior to psychoeducation [17], and produced significant changes in the brain through functional brain image research [18]. Previous research has examined the efficacy of EMDR treatment for children with PTSD compared with untreated children in a waiting list control group participating in a randomized controlled superiority trial, reporting that the EMDR group showed significantly greater alleviation of PTSD-related symptoms compared with the waiting list control group [19]. Bae et al. [20] reported the potential application of EMDR for treating depressive disorders related not only to trauma but also to stressful life events. Lee and Drummond [21] determined that EMDR can relieve distress through mechanisms dissimilar to those of traditional methods such as CBT and psychoeducation; however, a significant reduction in vividness and the symptom of intrusion occurred only in the eye movement group but not in the other intervention group. According to the results of a study on adolescents experiencing Typhoon Morakot, adolescents suffering from multiple comorbidities, including PTSD and MDD, have an increased risk of suicide, thus rendering the intervention more complicated and time emergent [8]. Brief and effective intervention strategies in managing complicated comorbidities should be administered as soon as possible to prevent a prolonged course of PTSD [22]. According to the aforementioned studies, the efficacy of EMDR in treating adolescents requires further investigation.

In this case-control study, we aimed to assess the intervention effects of four-session EMDR in reducing the severity of the psychological impact of Typhoon Morakot (including disaster-related anxiety, general anxiety, and depression) in Taiwanese adolescents who experienced Typhoon Morakot by comparing our results with those receiving treatment as usual (TAU). We hypothesized that the four-session EMDR would show stronger treatment effects than TAU would for adolescents with a significant psychological disturbance who experienced Typhoon Morakot.

Methods

Participants

A total of 271 adolescents were diagnostically interviewed 3 months after Typhoon Morakot; previous studies have described the prevalence rates of adolescents with PTSD related to Typhoon Morakot, MDD, and suicide risk [8–10]. The assessment results were provided to the adolescents, their families, and school teachers. The researchers arranged lectures for the adolescents' parents and school

teachers to improve their abilities in managing the mental health problems of the adolescents and to inform them about the referral for intensive psychotherapy and psychopharmacological treatment.

Among the 271 adolescents, 97 of them with PTSD related to Typhoon Morakot, MDD, or current moderate or high suicide risk were classified as having a significant psychological disturbance. The adolescents' parents were approached to obtain informed consent for the participation of the adolescents in the intervention program. Adolescents who moved to other schools ($N = 4$) and those who had previously received intervention from counselors of another institution ($N = 10$) were excluded from this study. Because the intervention program would be conducted in schools, the principals of the schools were also approached and provided detailed explanations to ensure that they agreed to the application of EMDR or TAU to their students. The Institutional Review Board of Kaohsiung Medical University approved the study.

Intervention

EMDR intervention

The intervention of EMDR commenced 3 months after Typhoon Morakot and continued for 3 months until the beginning of winter vacation. The participants received up to four weekly sessions of EMDR performed by three psychologists and one psychiatrist during a period of 2 months. The treatment was developed based on Adaptive Information Processing Model proposed by Shapiro and Grand [23]. This model suggests that psychopathology results during distressing experiences are processed inadequately and hypothesizes that EMDR expedites information processing, resulting in the adaptive resolution of traumatic memories. In this study, the training for the EMDR therapists included basic assumptions, treatment procedures, and clinical observations. The treatment manual, refined from that by the presented by Shapiro and Grand [23], provided various in-session transcripts and illustrated the application of EMDR in addressing the past events that have laid the foundation for dysfunction, present circumstances that elicit distress, and skills acquisition needed for adaptive functioning. Thus, the treatment aimed to mitigate excessive physical distress associated with flashback memories, correct autobiographical memory disturbances, and remove the avoidance behavior and negative cognitive thoughts associated with traumatic events. The initial sessions lasted 60 minutes and included the administration and explanation of the EMDR process to the participants. The next three sessions lasted approximately 30–40 minutes. These three sessions followed the EMDR protocols with the participant identifying the most vivid visual image related to the memory (if available), a negative belief about themselves, and related emotions and bodily sensations. The participants then identified a preferred positive belief. Subsequently, the validity of the positive belief was rated, as was the intensity of the negative emotions. The therapist then proceeded with the desensitization phase. The therapist training included real-time demonstration during the training period and individual postsession and weekly group supervision meetings to ensure that the therapists adhered

to the EMDR protocol. The participants in the EMDR group also received a weekly group psychoeducation session identical to that provided to the TAU group.

TAU intervention

The TAU group participants attended a weekly group psychoeducation session that was led by the mentors of the class and were assisted by psychologists. In the first 20-minute session, the mentors of the class explained the usefulness of the knowledge and motivated the adolescents to follow the advice provided during the psychoeducation program. The program then followed psychoeducational principles for guiding the treatment of PTSD proposed by Foa et al. [24], such as installation of hope, an introduction to the symptoms of PTSD and depression, and encouragement to verbally express distress and ask for help if needed. The TAU group attended from four to six sessions of weekly group psychoeducation sessions of approximately 40 minutes each during regular class hours.

Allocation

The adolescents whose parents and school principals agreed to participate in receiving EMDR intervention and the standard consultation by school counselors were assigned to the EMDR and TAU groups, respectively. Participants in both the EMDR and TAU groups were enrolled within the same timeline.

Pretest and posttest assessment

The adolescents in the EMDR and TAU intervention groups were assessed using the Chinese version of the Impact of Events Scale-Revised (C-IES-R), the Taiwanese version of the Multidimensional Anxiety Scale for Children (MASC-T), and the Mandarin Chinese version of the Center for Epidemiologic Studies Depression Scale (CES-D) prior to and after intervention during the same period. The assessment was performed using self-reported questionnaires. Although the administrators of the questionnaires were not blind to treatment assignment, they were not involved in any therapeutic interventions.

The 22-item C-IES-R is used to assess the three most commonly reported psychological response patterns associated with trauma: intrusive experiences, avoidant behaviors, and hyperarousal symptoms [25]. The C-IES-R has been reported to have a high internal consistency and favorable scale equivalence compared with the original English version [26]. The participants were requested to report the degree to which Typhoon Morakot psychologically affected them during the previous week on a 5-point scale, ranging from 0 (absence of symptoms) to 4 (maximum symptomatology). Scores on the subscales and total scale were summed to indicate the severity of the psychological reactions to Typhoon Morakot.

The MASC-T [27] was translated from the original MASC [28] and evaluates the level of anxiety symptoms in children and adolescents with 39 items answered on a 4-point Likert scale, where 0 = never true about me, 1 = rarely true about me, 2 = sometimes true about me, and 3 = often true about me. The MASC-T is composed of four

subscales, including physical symptoms (12 items), harm avoidance (9 items), social anxiety (9 items), and separation/panic (9 items). A previous study confirmed the adequacy of the 4-factor structure of the MASC-T and internal consistency and reliability when used to assess Taiwanese children and adolescents [27].

The 20-item Mandarin Chinese version [29] of the CES-D [30] is a self-administered evaluation scale assessing the frequency of depressive symptoms in the preceding week. The degree of depression was assessed on a 4-point scale, with scores ranging from 0 (none or very few) to 3 (always). Higher CES-D scores indicate more severe depression. The Cronbach α for the CES-D scale used to assess Taiwanese adolescents was 0.93 and the 2-week test–retest reliability (r) was 0.78 [31].

The postintervention assessments were conducted by evaluators blind to the results of preintervention assessments. Fig. 1 shows a flowchart of the assessment process in this study.

Statistical analyses

Age, sex, and preintervention scores on the C-IES-R, MASC-T, and CES-D were compared between the EMDR and TAU

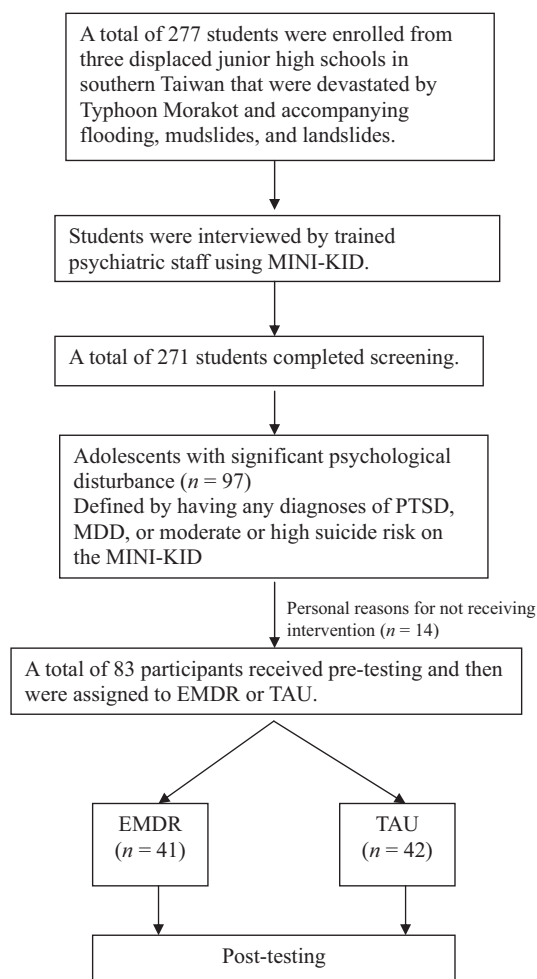


Figure 1. Flow of participants in the study.

groups using the t test and Chi-square test. To examine whether EMDR intervention had greater effects on the alleviation of disaster-related anxiety, general anxiety, and depressive symptoms than did TAU intervention, however, the postintervention scores on the C-IES-R, MASC-T, and CES-D were compared between the EMDR and TAU groups using the multivariate analysis of covariance (MANCOVA) with the preintervention scores, age, and sex used as covariates. A p value < 0.05 was considered statistically significant.

Results

Of 97 adolescents with PTSD, MDD, or current moderate or high suicide risk, 14 adolescents did not receive any intervention because their parents did not approve or because they were absent from school. A total of 41 adolescents (19 males and 22 females, aged 14.24 ± 0.99 years, range 12–15 years) and 42 adolescents (15 males and 27 females, aged 14.48 ± 0.92 years, range 12–15 years) were allocated to the EMDR and TAU groups, respectively. Sex ($\chi^2 = 2.90$, $p = 0.33$) or age ($t = 0.52$, $p = 0.47$) did not differ between the EMDR and TAU groups. The proportion of participants diagnosed with MDD did not differ between the EMDR ($N = 21$) and TAU groups ($N = 19$, $\chi^2 = 0.30$, $p = 0.59$), whereas that of participants diagnosed with PTSD was higher in the EMDR group ($N = 41$) than in the TAU group ($N = 33$, $\chi^2 = 9.85$, $p = 0.002$).

Table 1 shows the preintervention and postintervention scores on the C-IES-R, MASC-T, and the CES-D in the EMDR and TAU groups, and the comparison of these scores between the groups from using MANCOVA. Compared with the average scores on the MASC-T among the Taiwanese adolescents aged 12–15 years in the community [girls: mean = 42.53, standard deviation (SD) = 15.34; boys: mean = 34.85, SD = 15.04] [27], the participants in both the EMDR (mean = 69.78, SD = 19.54) and TAU groups (mean = 48.02, SD = 12.83) exhibited more severe anxiety symptoms on the

Table 1 Comparison of scores on the C-IES-R, MASC-T, and CES-D between the EMDR and TAU groups using multivariate analysis of covariance (MANCOVA).

	Prior to intervention		After intervention		F	p
	Mean	SD	Mean	SD		
C-IES-R						
EMDR	34.02	19.85	18.37	19.60	3.79	0.05
TAU	23.10	18.21	21.36	17.73		
MASC-T						
EMDR	69.78	19.54	30.61	25.70	9.39	0.03
TAU	48.02	19.39	41.88	20.51		
CES-D						
EMDR	25.10	11.50	14.78	11.36	11.87	0.01
TAU	23.14	10.45	21.07	9.85		

CES-D = Center for Epidemiologic Studies Depression Scale; C-IES-R = Chinese version of the Impact of Events Scale-Revised; EMDR = eye movement desensitization and reprocessing; MASC-T = Taiwanese version of the Multidimensional Anxiety Scale for Children; TAU = treatment as usual.

MASC-T. Compared with the average scores on the CES-D among the Taiwanese adolescents in the community (mean = 16.62, SD = 10.03) [31], the participants in both the EMDR (mean = 25.10, SD = 11.50) and TAU groups (mean = 23.14, SD = 10.45) showed a higher number of severe depressive symptoms on the CES-D.

The severity of psychological impact on the C-IES-R in the TAU group changed from 23.10 (SD = 18.21) to 21.36 (SD = 17.73), whereas that in the EMDR group changed from 34.02 (SD = 19.85) to 18.37 (SD = 19.60). The severity of anxiety on the MASC-T in the TAU group changed from 48.02 (SD = 12.83) to 41.88 (SD = 20.51), whereas that in the EMDR group changed from 69.78 (SD = 19.54) to 30.61 (SD = 19.39). The severity of depression on the CES-D in the TAU group changed from 23.14 (SD = 10.45) to 21.07 (SD = 9.85), whereas that in the EMDR group changed from 25.10 (SD = 11.50) to 14.78 (SD = 11.36). No dropouts or complaints of adverse effects were noted in either group. The results of the MANCOVA indicated that when preintervention scores, sex, and age were used as covariates, the EMDR group showed significantly lower postintervention scores on the MASC-T ($p = 0.03$) and CES-D ($p = 0.01$) than those of the TAU group, indicating that EMDR exerted a significantly higher effect than did TAU in reducing general anxiety and depressive symptoms. The postintervention scores on the C-IES-R of the EMDR group were lower than those of the TAU group ($p = 0.05$), indicating that EMDR might have a higher effect than TAU does in reducing disaster-related anxiety. The size (Cohen's d) of the EMDR effect on the C-IES-R, MASC-T, and CES-D was 0.16, 0.49, and 0.59, respectively.

Discussion

In this case-control study, we observed that EMDR was more effective in reducing the severity of disaster-related anxiety caused by Typhoon Morakot than TAU among adolescents who experienced Typhoon Morakot. None of the participants dropped out, implying that the EMDR intervention program was acceptable to the adolescents and their families. Moreover, EMDR had no adverse effects during the intervention. Although EMDR includes processing traumatic events resulting in psychological distress, no participant showed an overall deterioration in PTSD symptoms. The results of this study support the possible clinical benefits of EMDR for adolescents who have developed significant psychological disturbances following a traumatic natural disaster.

In addition, our study is the first to report that EMDR alleviated general anxiety symptoms measured using the MASC-T. Notably, using EMDR for treating PTSD was based on the hypothesis that if the information associated with a distressing or traumatic experience is avoided, the initial perceptions, emotions, and distorted thoughts would be restored to what they were at the time of the event, which would prevent victims from completely processing their traumatic memories [32]. A recent study reported that EMDR can limit working memory resources while the participants are exposed to negative ideation, thus rendering the image less vivid and the avoidance reduced [33]. We further analyzed the change of scores on the MASC-T subscales and determined that EMDR improved anxiety symptoms on the

harm avoidance MASC-T subscale ($p = 0.01$). The results suggest that identifying intrusive memories regarding trauma and desensitizing vividness and related emotional distress [33,34] might reduce harm avoidance scores and partially account for the effects of EMDR.

Effective and efficient therapies are necessary in disastrous situations. Previous meta-analysis studies have evaluated the effects of EMDR and other school-based intervention programs of PTSD and reported a medium-large effect for PTSD [16,35]. Furthermore, these meta-analysis studies have revealed that trauma-focused CBT and EMDR are equally efficacious [12,35]. Moreover, several other studies have examined the effects of EMDR that focused on adolescents with mixed traumatic experiences; however, limited data exist on the EMDR treatment of short duration for adolescents [22,36]. In this study, we evaluated the effects of EMDR on adolescents attending an average of four sessions compared with previously reported EMDR protocols requiring four to seven sessions [32,34]. In addition, EMDR treatment components for children slightly differed from those in adults. In this study, the EMDR protocol focused on the efficient desensitization of the traumatic memory, which would reduce the symptoms earlier compared with the CBT protocols [32,34,37]. Previous research showed that compared with non-EMDR therapy, EMDR therapy exerts a greater effect in reducing psychophysiological disturbances that may aid in processing negative memories [33]. Furthermore, the brain image study determined that activities in the frontal, parieto-occipital, and visual cortices and hippocampus increased after the intervention of EMDR [38]. These areas moderate the experience of a real versus perceived threat. However, it indicates that after EMDR intervention, adolescents with PTSD may no longer be hypervigilant during processing traumatic memory [38]. Thus, it would help the victims to resume conversation with related story and symptoms [39].

In addition, we reported that self-reported depression improved significantly through EMDR intervention. Previous studies have found that depressive symptoms were alleviated during the course of CBT that initially targets PTSD [32,40]. In addition, it has been reported that the clinical levels of depressive symptoms in adolescents experiencing trauma may develop secondary to PTSD [5]. Thus, these findings suggest that intervention should be targeted at alleviating PTSD symptoms, which is the most emergent step for adolescents with PTSD, and depressive symptoms after experiencing major traumatic disasters. The alleviation of depressive symptoms may occur following the alleviation of PTSD symptoms.

Participants in the TAU group did not improve significantly over time on the measures of disaster-related anxiety, general anxiety, and depressive symptoms after receiving psychoeducation for trauma during a 4-week period. However, this result is inconsistent with that of a previous study that showed spontaneous recovery over time in a TAU group [37]; however, spontaneous recovery may not occur in a short period of 4 weeks. In this study, adolescents were allocated to three temporary boarding areas where they received education according to a strict schedule; thus, they lagged behind in studies for the major year-end examinations. The anxiety associated with not preparing well for their school examinations added more

burden on the psychoeducation group. In addition, most of them lived in group dormitories and visited their family members only on weekends; therefore, they lacked places for relaxation and support.

Our study had several limitations that deserve attention. First, relatively few adolescents participated and eventually enrolled in the treatment. In addition, despite the few participants, the inclusion criteria were deliberately well defined by the psychiatric diagnostic interviews that involved using the MINI-KID to ensure the homogenous diagnosis of the participants prior to intervention. To overcome this limitation, replication with a larger sample is indicated. Second, the effects of EMDR and TAU on psychological disturbances were evaluated in a short period of 4 weeks, and data for long follow-up periods were lacking. Third, adaptations to the protocol may be necessary for adolescents with various traumatic disaster experiences. For example, additional sessions to process multiple traumatic memories by using the different levels of EMDR may be necessary for adolescents with multiple traumatic experiences. Finally, the evaluation of the effectiveness of the EMDR protocol for the adolescents with traumatic experiences other than natural disaster experiences is necessary to test the generalizability of the present positive findings. Furthermore, the nonrandomized trial design failed to control for the group differences from all domains, thus resulting in some unbalanced preintervention scores and PTSD diagnosis between the groups. Because the allocation to the EMDR and TAU groups were based on the opinions of parents and school principals, they may make their decision according to the severity of the psychological disturbance observed in the adolescents. This may partially account for the imbalance of preintervention scores on some scales. Furthermore, randomized case–control trials are necessary to confirm the effects of EMDR.

Conclusions

The results of this study show that EMDR demonstrated significantly higher effects in reducing the severity of disaster-related anxiety, general anxiety, and depressive symptoms than did TAU in adolescents who experienced Typhoon Morakot. The results empirically support the efficacy of individual, short-term, community-based EMDR for treating adolescents with psychological disturbances caused by natural disasters. Furthermore, the randomized case–control study with larger samples will allow the identification of specific therapy components and treatment response predictors.

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References

- [1] Kristensen P, Weisaeth L, Heir T. Psychiatric disorders among disaster bereaved: an interview study of individuals directly or not directly exposed to the 2004 tsunami. *Depress Anxiety* 2009;26:1127–33.
- [2] Lau JT, Yu X, Zhang J, Mak WW, Choi KC, Lui WW, et al. Psychological distress among adolescents in Chengdu, Sichuan at 1 month after the 2008 Sichuan earthquake. *J Urban Health* 2010;87:504–23.
- [3] Liu ZY, Yang YF, Ye YL, Zeng ZQ, Xiang YJ, Yuan P. One-year follow-up study of post-traumatic stress disorder among adolescents following the Wen-Chuan earthquake in China. *Biosci Trends* 2010;4:96–102.
- [4] Lindal E, Stefansson JG. The long-term psychological effect of fatal accidents at sea on survivors: a cross-sectional study of North-Atlantic seamen. *Soc Psychiatry Psychiatr Epidemiol* 2011;46:239–46.
- [5] Bolton D, O’Ryan D, Udwin O, Boyle S, Yule W. The long-term psychological effects of a disaster experienced in adolescence: II. General psychopathology. *J Child Psychol Psychiatry* 2000;41:513–23.
- [6] Sheehan DV, Lecrubier Y, Sheehan KH, Amorim P, Janavs J, Weiller E, et al. The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *J Clin Psychiatry* 1998;59:22–33.
- [7] American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Washington, DC: American Psychiatric Press; 1994.
- [8] Tang TC, Yen CF, Cheng CP, Yang P, Chen CS, Yang RC, et al. Suicide risk and its correlate in adolescents who experienced typhoon-induced mudslides: a structural equation model. *Depress Anxiety* 2010;27:1143–8.
- [9] Yang P, Yen CF, Tang TC, Chen CS, Yang RC, Huang MS, et al. Posttraumatic stress disorder in adolescents after Typhoon Morakot-associated mudslides. *J Anxiety Disord* 2011;25:362–8.
- [10] Yen CF, Tang TC, Yang P, Chen CS, Cheng CP, Yang RC, et al. A multidimensional anxiety assessment of adolescents after Typhoon Morakot-associated mudslides. *J Anxiety Disord* 2011; 25:106–11.
- [11] Cukor J, Olden M, Lee F, Difede J. Evidence-based treatments for PTSD, new directions, and special challenges. *Ann N Y Acad Sci* 2010;1208:82–9.
- [12] Watson JC, Bedard DL. Clients’ emotional processing in psychotherapy: a comparison between cognitive–behavioral and process-experiential therapies. *J Consult Clin Psychol* 2006; 74:152–9.
- [13] Shapiro F. EMDR 12 years after its introduction: past and future research. *J Clin Psychol* 2002;58:1–22.
- [14] Högberg G, Pagani M, Sundin O, Soares J, Aberg-Wistedt A, Tärnell B, et al. Treatment of post-traumatic stress disorder with eye movement desensitization and reprocessing: outcome is stable in 35-month follow-up. *Psychiatry Res* 2008;159:101–8.
- [15] Van den Hout MA, Engelhard IM, Rijkeboer MM, Koekebakker J, Hornsveld H, Leer A, et al. EMDR: eye movements superior to beeps in taxing working memory and reducing vividness of recollections. *Behav Res Ther* 2011;49:92–8.
- [16] Rolfesnes ES, Idsoe T. School-based intervention programs for PTSD symptoms: a review and meta-analysis. *J Trauma Stress* 2011;24:155–65.
- [17] Schubert SJ, Lee CW, Drummond PD. The efficacy and psychophysiological correlates of dual-attention tasks in eye movement desensitization and reprocessing (EMDR). *J Anxiety Disord* 2011;25:1–11.
- [18] Samara Z, Elzinga BM, Slagter HA, Nieuwenhuis S. Do horizontal saccadic eye movements increase interhemispheric coherence? Investigation of a hypothesized neural mechanism underlying EMDR. *Front Psychiatry* 2011;9:2–4.
- [19] Ahmad A, Larsson B, Sundelin-Wahlsten V. EMDR treatment for children with PTSD: results of a randomized controlled trial. *Nord J Psychiatry* 2007;61:349–54.

- [20] Bae H, Kim D, Park YC. Eye movement desensitization and reprocessing for adolescent depression. *Psychiatry Investig* 2008;5:60–5.
- [21] Lee CW, Drummond PD. Effects of eye movement versus therapist instructions on the processing of distressing memories. *J Anxiety Disord* 2008;22:801–8.
- [22] Ponniah K, Hollon SD. Empirically supported psychological treatments for adult acute stress disorder and posttraumatic stress disorder: a review. *Depress Anxiety* 2009;26:1086–109.
- [23] Shapiro R, Grand C. *EMDR solutions II: for depression, eating disorders, performance, and more*. New York: Norton Professional Books; 2009.
- [24] Foa EB, Keane TM, Friedman MJ. *Effective treatments for PTSD: practice guidelines from the International Society for Traumatic Stress Studies*. New York: Guilford Press.
- [25] Weiss DS, Marmar CR. The Impact of Event Scale-Revised. In: Wilson JP, Keane TM, editors. *Assessing psychological trauma and PTSD*. New York: Guilford Press; 1997. p. 399–411.
- [26] Wu KK, Chan SK. The development of the Chinese version of Impact of Event Scale-Revised (C-IES-R). *Soc Psychiatry Psychiatr Epidemiol* 2003;38:94–8.
- [27] Yen CF, Yang P, Wu YY, Hsu FC, Cheng CP. Factor structure, reliability and validity of the Taiwanese version of the Multidimensional Anxiety Scale for Children. *Child Psychiatry Hum Dev* 2010;41:342–52.
- [28] March JS. *Multidimensional Anxiety Scale for Children*. North Tonawanda, NY: Multi-Health Systems Inc.; 1997.
- [29] Chien CP, Cheng TA. Depression in Taiwan: epidemiological survey utilizing CES-D. *Seishin Shinkeigaku Zasshi* 1985;87:335–8.
- [30] Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. *Appl Psychol Measur* 1977;1:385.
- [31] Yen CF, Ko CH, Yen JY, Cheng CP. The multidimensional correlates associated with short nocturnal sleep duration and subjective insomnia among Taiwanese adolescents. *Sleep* 2008;31:1515–25.
- [32] Shapiro F. *Eye movement desensitization and reprocessing: basic principles, protocols, and procedures*. 2nd ed. New York: Guilford Press; 2001.
- [33] Van den Hout MA, Engelhard IM, Beetsma D, Slofstra C, Hornsveld H, Houtveen J, et al. EMDR and mindfulness: Eye movements and attentional breathing tax working memory and reduce vividness and emotionality of aversive ideation. *J Behav Ther Exp Psychiatry* 2011;42:423–31.
- [34] Shapiro F. *EMDR as an integrative psychotherapy approach: EMDR and new notes on adaptive information processing: case formulation principles, scripts and worksheets*. New York: EMDR Humanitarian Assistance Programs; 2006.
- [35] Seidler GH, Wagner FE. Comparing the efficacy of EMDR and trauma-focused cognitive-behavioral therapy in the treatment of PTSD: a meta-analytic study. *Psychol Med* 2006;36:1515–22.
- [36] Taylor S, Thordarson DS, Maxfield L, Fedoroff IC, Lovell K, Ogradniczuk J. Comparative efficacy, speed, and adverse effects of three PTSD treatments: exposure therapy, EMDR, and relaxation training. *J Consult Clin Psychol* 2003;71:330–8.
- [37] Ehlers A, Clark DM, Hackmann A, McManus F, Fennell M, Herbert C, et al. Randomized controlled trial of cognitive therapy, a self-help booklet, and repeated assessments as early interventions for posttraumatic stress disorder. *Arch Gen Psychiatry* 2003;60:1024–32.
- [38] Pagani M, Högberg G, Salmaso D, Nardo D, Sundin O, Jonsson C, et al. Effects of EMDR psychotherapy on 99mTc-HMPAO distribution in occupation-related post-traumatic stress disorder. *Nucl Med Commun* 2007;28:757–65.
- [39] Friedman MJ, Keane TK, Resick PA. *Handbook of PTSD: science and practice*. New York: Guilford Press; 2010.
- [40] Iverson KM, Gradus JL, Resick PA, Suvak MK, Smith KF, Monson CM. Cognitive-behavioral therapy for PTSD and depression symptoms reduces risk for future intimate partner violence among interpersonal trauma survivors. *J Consult Clin Psychol* 2011;79:193–202.