

EMDR THERAPY RESEARCH OVERVIEW: 1989-2016

A partial list of citations of research on EMDR therapy and the adaptive information processing model. adapted with permission from the EMDR Institute page: <http://www.emdr.com/research-overview/>

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International Treatment Guidelines

- **American Psychiatric Association (2004).** *Practice Guideline for the Treatment of Patients with Acute Stress Disorder and Posttraumatic Stress Disorder.* Arlington, VA: American Psychiatric Association Practice Guidelines.

EMDR given the same status as CBT as an effective treatment for ameliorating symptoms of both acute and chronic PTSD.

- **Bleich, A., Kotler, M., Kutz, I., & Shalev, A. (2002).** A position paper of the (Israeli) National Council for Mental Health: *Guidelines for the assessment and professional intervention with terror victims in the hospital and in the community.* Jerusalem, Israel.

EMDR is one of only three methods recommended for treatment of terror victims.

- **California Evidence-Based Clearinghouse for Child Welfare (2010).** *Trauma Treatment for Children.* <http://www.cebc4cw.org>.

EMDR and Trauma-focused CBT are considered "Well-Supported by Research Evidence."

- **Chambless, D.L. et al. (1998).** Update of empirically validated therapies, II. *The Clinical Psychologist*, 51, 3-16.

According to a taskforce of the Clinical Division of the American Psychological Association, the only methods empirically supported for the treatment of any post-traumatic stress disorder population were EMDR, exposure therapy, and stress inoculation therapy .

<http://www.emdrresearchfoundation.org/index.php/for-professionals/emdr-therapy-bibliography>

- **CREST (2003).** *The management of post traumatic stress disorder in adults.* A publication of the Clinical Resource Efficiency Support Team of the Northern Ireland Department of Health, Social Services and Public Safety, Belfast.

Of all the psychotherapies, EMDR and CBT were stated to be the treatments of choice

- **Department of Veterans Affairs & Department of Defense (2004).** *VA/DoD Clinical Practice Guideline for the Management of Post-Traumatic Stress.* Washington, DC. http://www.oqp.med.va.gov/cpg/PTSD/PTSD_cpg/frameset.htm

EMDR was one of four therapies recommended and given the highest level of evidence.

- **Dutch National Steering Committee Guidelines Mental Health Care (2003).** *Multidisciplinary Guideline Anxiety Disorders.* Quality Institute Health Care CBO/Trimbos Intitute. Utrecht, Netherlands.

EMDR and CBT are both treatments of choice for PTSD

- **Foa, E.B., Keane, T.M., Friedman, M.J., & Cohen, J.A. (2009).** *Effective treatments for PTSD: Practice Guidelines of the International Society for Traumatic Stress Studies.* New York: Guilford Press.

EMDR was listed as an effective and empirically supported treatment for PTSD, and was given an AHCPR "A" rating for adult PTSD. This guideline specifically rejected the findings of the previous Institute of Medicine report, which stated that more research was needed to judge EMDR effective for adult PTSD. With regard to the application of EMDR to children, an AHCPR rating of Level B was assigned. Since the time of this publication, three additional randomized studies on EMDR have been completed (see below).

- **INSERM (2004).** *Psychotherapy: An evaluation of three approaches.* French National Institute of Health and Medical Research, Paris, France.

Of the different psychotherapies, EMDR and CBT were stated to be the treatments of choice for trauma victims.

- **National Collaborating Centre for Mental Health (2005).** *Post traumatic stress disorder (PTSD): The management of adults and children in primary and secondary care.* London: National Institute for Clinical Excellence.

Trauma-focused CBT and EMDR were stated to be empirically supported treatments for choice for adult PTSD.

- **SAMHSA's National Registry of Evidence-based Programs and Practices (2011).** <http://legacy.nreppadmin.net/ViewIntervention.aspx?id=199>. The Substance Abuse and Mental Health Services Administration (SAMHSA) is an agency of the US Department of Health and Human Services (HHS).

This national registry (NREPP) cites EMDR as evidence-based practice for treatment of PTSD, anxiety and depression symptoms. Their review of the evidence also indicated that EMDR leads to an

improvement in mental health functioning.

- **Sjöblom, P.O., Andréewitch, S . Bejerot, S., Mörtberg, E. , Brinck, U., Ruck, C., & Körlin, D. (2003).** *Regional treatment recommendation for anxiety disorders.* Stockholm: Medical Program Committee/Stockholm City Council, Sweden.

Of all psychotherapies CBT and EMDR are recommended as treatments of choice for PTSD.

- **Therapy Advisor (2004-11):** <http://www.therapyadvisor.com>

An NIMH sponsored website listing empirically supported methods for a variety of disorders. EMDR is one of three treatments listed for PTSD.

- **United Kingdom Department of Health (2001).** *Treatment choice in psychological therapies and counselling evidence based clinical practice guideline.* London, England.

Best evidence of efficacy was reported for EMDR, exposure, and stress inoculation

- **World Health Organization (2013).** *Guidelines for the management of conditions specifically related to stress.* Geneva, Switzerland, World Health Organization. http://www.who.int/mental_health/emergencies/stress_guidelines/en/

Trauma-focused CBT and EMDR are the only psychotherapies recommended for children, adolescents and adults with PTSD. “Like CBT with a trauma focus, EMDR aims to reduce subjective distress and strengthen adaptive cognitions related to the traumatic event. Unlike CBT with a trauma focus, EMDR does not involve (a) detailed descriptions of the event, (b) direct challenging of beliefs, (c) extended exposure, or (d) homework.” (p. 1)

Meta-analyses

EMDR has been compared to numerous exposure therapy protocols, with and without CT techniques. It should be noted that exposure therapy uses one to two hours of daily homework and EMDR uses none. The most recent meta-analyses are listed here.

- **Bisson, J., Roberts, N.P., Andrew, M., Cooper, R. & Lewis, C. (2013).** Psychological therapies for chronic post-traumatic stress disorder (PTSD) in adults (Review). *Cochrane Database of Systematic Reviews 2013*, DOI: 10.1002/14651858.CD003388.pub4

Research indicates that CBT and EMDR therapy are superior to all other treatments.

- **Bradley, R., Greene, J., Russ, E., Dutra, L., & Westen, D. (2005).** A multidimensional meta-analysis of psychotherapy for PTSD. *American Journal of Psychiatry*, 162, 214-227.

EMDR is equivalent to exposure and other cognitive behavioral treatments and all “are highly efficacious in reducing PTSD symptoms.

- **Davidson, P.R., & Parker, K.C.H. (2001).** Eye movement desensitization and reprocessing (EMDR): A meta-analysis. *Journal of Consulting and Clinical Psychology*, 69, 305-316.

EMDR is equivalent to exposure and other cognitive behavioral treatments. It should be noted that exposure therapy uses one to two hours of daily homework and EMDR uses none.

- **Lee, C.W., & Cuijpers, P. (2013).** A meta-analysis of the contribution of eye movements in processing emotional memories. *Journal of Behavior Therapy & Experimental Psychiatry*, 44, 231-239.

The effect size for the additive effect of eye movements in EMDR treatment studies was moderate and significant (Cohen's $d = 0.41$). For the second group of laboratory studies the effect size was large and significant ($d = 0.74$).

- **Maxfield, L., & Hyer, L.A. (2002).** The relationship between efficacy and methodology in studies investigating EMDR treatment of PTSD. *Journal of Clinical Psychology*, 58, 23-41

A comprehensive meta-analysis reported the more rigorous the study, the larger the effect.

- **Rodenburg, R., Benjamin, A., de Roos, C, Meijer, A.M., & Stams, G.J. (2009).** Efficacy of EMDR in children: A meta – analysis. *Clinical Psychology Review*, 29, 599-606.

Results indicate efficacy of EMDR when effect sizes are based on comparisons between EMDR and non-established trauma treatment or no-treatment control groups, and incremental efficacy when effect sizes are based on comparisons between EMDR and established (CBT) trauma treatment.

- **Seidler, G.H., & Wagner, F.E. (2006).** Comparing the efficacy of EMDR and trauma-focused cognitive-behavioral therapy in the treatment of PTSD: a meta-analytic study. *Psychological Medicine*, 36,1515-1522.

Results suggest that in the treatment of PTSD, both therapy methods tend to be equally efficacious.

- **Watts, B.V. et al. (2013).** Meta-analysis of the efficacy of treatments for posttraumatic stress disorder. *Journal of Clinical Psychiatry*, 74, e541-550. doi: 10.4088/JCP.12r08225

CBT and eye movement desensitization and reprocessing were the most often-studied types of psychotherapy. Both were effective.

Randomized Clinical Trials

- **Abbasnejad, M., Mahani, K. N., & Zamyad, A. (2007).** Efficacy of “eye movement desensitization and reprocessing” in reducing anxiety and unpleasant feelings due to earthquake experience. *Psychological Research*, 9, 104-117.

EMDR is effective in reducing earthquake anxiety and negative emotions (e.g. PTSD, grief, fear, intrusive thoughts, depression, etc) resulting from earthquake experience. Furthermore, results show that, improvement due to EMDR was maintained at a one month follow up.

- **Ahmad A, Larsson B, & Sundelin-Wahlsten V. (2007).** EMDR treatment for children with PTSD: Results of a randomized controlled trial. *Nord J Psychiatry*, 61, 349-54.

Thirty-three 6-16-year-old children with a DSM-IV diagnosis of PTSD were randomly assigned to eight weekly EMDR sessions or the WLC group. EMDR was found to be an effective treatment in children with PTSD from various sources and who were suffering from a variety of co-morbid conditions.

- **Arabia, E., Manca, M.L. & Solomon, R.M. (2011).** EMDR for survivors of life-threatening cardiac events: Results of a pilot study. *Journal of EMDR Practice and Research*, 5, 2-13.

Forty-two patients undergoing cardiac rehabilitation . . . were randomized to a 4-week treatment of EMDR or imaginal exposure (IE). EMDR was effective in reducing PTSD, depressive, and anxiety symptoms and performed significantly better than IE for all variables. Because the standardized IE procedures used were those employed in-session during [prolonged exposure the results are also instructive regarding the relative efficacy of both treatments without the addition of homework.

- **Capezzani et al. (2013).** EMDR and CBT for cancer patients: Comparative study of effects on PTSD, anxiety, and depression. *Journal of EMDR Practice and Research*, 5, 2-13.

This randomized pilot study reported that after eight sessions of treatment, EMDR therapy was superior to a variety of CBT techniques. “Almost all the patients (20 out of 21, 95.2%) did not have PTSD after the EMDR treatment.

- **Carlson, J., Chemtob, C.M., Rusnak, K., Hedlund, N.L., & Muraoka, M.Y. (1998).** Eye movement desensitization and reprocessing (EMDR): Treatment for combat-related post-traumatic stress disorder. *Journal of Traumatic Stress*, 11, 3-24.

Twelve sessions of EMDR eliminated post-traumatic stress disorder in 77.7% of the multiply traumatized combat veterans studied. There was 100% retention in the EMDR condition. Effects were maintained at follow-up. This is the only randomized study to provide a full course of treatment with combat veterans. Other studies (e.g., Boudewyns/Devilly/Jensen/Pitman et al./Macklin et al.) evaluated treatment of only one or two memories, which, according to the International Society for Traumatic Stress Studies Practice Guidelines (2000), is inappropriate for multiple-trauma survivors. The VA/DoD Practice Guideline (2004) also indicates these studies (often with only two sessions) offered insufficient treatment doses for veterans. EMDR therapy is listed as an “A” level treatment in the VA/DoD Practice Guideline (2004, 2010).

- **Carletto, S., Borghi, M., Bertino, G., Oliva, F., Cavallo, M., Hofmann, A., & Ostacoli, L. (2016).** Treating post-traumatic stress disorder in patients with multiple sclerosis: A randomized controlled trial comparing the efficacy of eye movement desensitization and reprocessing and relaxation therapy. *Frontiers in Psychology*, 7.

In the EMDR condition, measurements at posttest and follow-up revealed 85% and 100% PTSD remission, respectively.

- **Chemtob, C.M., Nakashima, J., & Carlson, J.G. (2002).** Brief-treatment for elementary school children with disaster-related PTSD: A field study. *Journal of Clinical Psychology*, 58, 99-112.

EMDR was found to be an effective treatment for children with disaster-related PTSD who had not responded to another intervention. This is the first controlled study for disaster-related PTSD, and the first controlled study examining the treatment of children with PTSD.

- **Cvetek, R. (2008).** EMDR treatment of distressful experiences that fail to meet the criteria for PTSD. *Journal of EMDR Practice and Research*, 2, 2-14.

EMDR treatment of disturbing life events (small “t” trauma) was compared to active listening, and wait list. EMDR produced significantly lower scores on the Impact of Event Scale (mean reduced from “moderate” to “subclinical”) and a significantly smaller increase on the STAI after memory recall.

- **de Bont, P. A., van den Berg, D. P., van der Vleugel, B. M., de Roos, C., de Jongh, A., van der Gaag, M., & van Minnen, A. M. (2016).** Prolonged exposure and EMDR for PTSD v. a PTSD waiting-list condition: effects on symptoms of psychosis, depression and social functioning in patients with chronic psychotic disorders. *Psychological Medicine*, 1-11.

In patients with chronic psychotic disorders PE and EMDR not only reduced PTSD symptoms, but also paranoid thoughts. Importantly, in PE and EMDR more patients accomplished the status of their psychotic disorder in remission.

- **de Roos, C. (2011).** A randomised comparison of cognitive behavioural therapy (CBT) and eye movement desensitisation and reprocessing (EMDR) in disaster exposed children. *European Journal of Psychotraumatology*, 2: 5694 – DOI: 10.3402/ejpt.v2i0.5694.

Children (n=52, aged 4-18) were randomly allocated to either CBT (n=26) or EMDR (n=26) in a disaster mental health after-care setting after an explosion of a fireworks factory. . . Both treatment approaches produced significant reductions on all measures and results were maintained at follow-up. Treatment gains of EMDR were reached in fewer sessions.

- **Diehle, J., Opmeer, B. C., Boer, F., Mannarino, A. P., & Lindauer, R. J. (2014).** Trauma-focused cognitive behavioral therapy or eye movement desensitization and reprocessing: What works in children with posttraumatic stress symptoms? A randomized controlled trial. *European Child & Adolescent Psychiatry*, 26, 227-236.

A mixed sample of full and partial PTSD was evaluated. [B]oth treatments are effective in children with PTSS in an outpatient setting. Results on both child and parent measures support this conclusion.

- **Edmond, T., Rubin, A., & Wambach, K. (1999).** The effectiveness of EMDR with adult female survivors of childhood sexual abuse. *Social Work Research*, 23, 103-116.

EMDR treatment resulted in lower scores (fewer clinical symptoms) on all four of the outcome measures at the three-month follow-up, compared to those in the routine treatment condition. The EMDR group also improved on all standardized measures at 18 months follow up (Edmond & Rubin, 2004, Journal of Child Sexual Abuse).

- **Edmond, T., Sloan, L., & McCarty, D. (2004).** Sexual abuse survivors' perceptions of the effectiveness of EMDR and eclectic therapy: A mixed-methods study. *Research on Social Work Practice*, 14, 259-272.

Combination of qualitative and quantitative analyses of treatment outcomes with important implications for future rigorous research. Survivors' narratives indicate that EMDR produces greater trauma resolution, while within eclectic therapy, survivors more highly value their relationship with their therapist, through whom they learn effective coping strategies.

- **Hogberg, G. et al., (2007).** On treatment with eye movement desensitization and reprocessing of chronic post-traumatic stress disorder in public transportation workers: A randomized controlled study. *Nordic Journal of Psychiatry*, 61, 54-61.

Employees who had experienced "person-under-train accident or had been assaulted at work were recruited." Six sessions of EMDR resulted in remission of PTSD in 67% compared to 11% in the wait list control. Significant effects were documented in Global Assessment of Function (GAF) and Hamilton Depression (HAM-D) score.

- **Follow-up: Högberg, G. et al. (2008).** Treatment of post-traumatic stress disorder with eye movement desensitization and reprocessing: Outcome is stable in 35-month follow-up. *Psychiatry Research*. 159, 101-108.

- **Ironson, G.I., Freund, B., Strauss, J.L., & Williams, J. (2002).** Comparison of two treatments for traumatic stress: A community-based study of EMDR and prolonged exposure. *Journal of Clinical Psychology*, 58, 113-128.

Both EMDR and prolonged exposure produced a significant reduction in PTSD and depression symptoms. Study found that 70% of EMDR participants achieved a good outcome in three active treatment sessions, compared to 29% of persons in the prolonged exposure condition. EMDR also had fewer dropouts.

- **Jaberghaderi, N., Greenwald, R., Rubin, A., Dolatabadim S., & Zand, S.O. (2004).** A comparison of CBT and EMDR for sexually abused Iranian girls. *Clinical Psychology and Psychotherapy*.

Both EMDR and CBT produced significant reduction in PTSD and behavior problems. EMDR was significantly more efficient, using approximately half the number of sessions to achieve results.

- **Jarero, I., Artigas, L., & Luber, M. (2011).** The EMDR protocol for recent critical incidents: Application in a disaster mental health continuum of care context. *Journal of EMDR Practice and Research*, 5, 82-94.

Participants were treated two weeks following a 7.2 earthquake in Mexico. One session of EMDR-PRECI produced significant improvement on symptoms of posttraumatic stress for both the immediate-treatment and waitlist/delayed treatment groups, with results maintained at 12-week follow-up, even though frightening aftershocks continued to occur frequently.

- **Jarero, I., & Uribe, S., Artigas, L., Givaudan, M. (2015).** EMDR protocol for recent critical incidents: A randomized controlled trial in a technological disaster context. *Journal of EMDR Practice and Research*, 9, 166–173.

Evaluation of co-workers 10 days after they witnessed seven people killed in an explosion revealed a mean of 22 on the SPRINT, indicating severe PTSD symptoms. After two consecutive-day 60-minute EMDR sessions the mean SPRINT scores for immediate and delayed treatment groups declined to equally low levels on both posttest and follow-up.

- **Kemp M., Drummond P., & McDermott B. (2010).** A wait-list controlled pilot study of eye movement desensitization and reprocessing (EMDR) for children with post-traumatic stress disorder (PTSD) symptoms from motor vehicle accidents. *Clinical Child Psychology and Psychiatry*, 15, 5-25.

An effect for EMDR was identified on primary outcome and process measures including the Child Post-Traumatic Stress – Reaction Index, clinician rated diagnostic criteria for PTSD, Subjective Units of Disturbance and Validity of Cognition scales. All participants initially met two or more PTSD criteria. After EMDR treatment, this decreased to 25% in the EMDR group but remained at 100% in the wait-list group.

- **Lee, C., Gavriel, H., Drummond, P., Richards, J. & Greenwald, R. (2002).** Treatment of post-traumatic stress disorder: A comparison of stress inoculation training with prolonged exposure and eye movement desensitization and reprocessing. *Journal of Clinical Psychology*, 58, 1071-1089.

Both EMDR and stress inoculation therapy plus prolonged exposure (SITPE) produced significant improvement, with EMDR achieving greater improvement on PTSD intrusive symptoms. Participants in the EMDR condition showed greater gains at three-month follow-

up. EMDR required three hours of homework compared to 28 hours for SITPE.

- **Marcus, S., Marquis, P. & Sakai, C. (1997).** Controlled study of treatment of PTSD using EMDR in an HMO setting. *Psychotherapy*, 34, 307-315.

Funded by Kaiser Permanente. Results show that 100% of single-trauma and 80% of multiple-trauma survivors were no longer diagnosed with post-traumatic stress disorder after six 50-minute sessions.

- **Marcus, S., Marquis, P. & Sakai, C. (2004).** Three- and 6-month follow-up of EMDR treatment of PTSD in an HMO setting. *International Journal of Stress Management*, 11, 195-208.

Funded by Kaiser Permanente, follow-up evaluation indicates that a relatively small number of EMDR sessions result in substantial benefits that are maintained over time.

- **Nijdam, Gersons, B.P.R, Reitsma, J.B., de Jongh, A. & Olf, M. (2012).** Brief eclectic psychotherapy v. eye movement desensitisation and reprocessing therapy in the treatment of post-traumatic stress disorder: Randomised controlled trial. *British Journal of Psychiatry*, 200, 224-231.

A comparison of “the efficacy and response pattern of a trauma-focused CBT modality, brief eclectic psychotherapy for PTSD with EMDR. Although both treatments are effective, EMDR results in a faster recovery compared with the more gradual improvement with brief eclectic psychotherapy.

- **Novo, P. et al. (2014).** Eye movement desensitization and reprocessing therapy in subsyndromal bipolar patients with a history of traumatic events: A randomized, controlled pilot-study. *Psychiatry Research*, 219, 122-128.

Although preliminary, our findings support the utility of this treatment approach and suggest that Eye Movement Desensitization and Reprocessing therapy could be a promising and safe therapeutic strategy to reduce trauma symptoms and stabilize mood in traumatized bipolar patients with subsyndromal symptoms.

- **Power, K.G., McGoldrick, T., Brown, K., et al. (2002).** A controlled comparison of eye movement desensitization and reprocessing versus exposure plus cognitive restructuring, versus waiting list in the treatment of post-traumatic stress disorder. *Journal of Clinical Psychology and Psychotherapy*, 9, 299-318.

Both EMDR and exposure therapy plus cognitive restructuring (with daily homework) produced significant improvement. EMDR was more beneficial for depression and required fewer treatment sessions.

- **Rothbaum, B. (1997).** A controlled study of eye movement desensitization and reprocessing in the treatment of post-traumatic stress disorder sexual assault victims. *Bulletin of the Menninger Clinic*, 61, 317-334.

Three 90-minute sessions of EMDR eliminated post-traumatic stress disorder in 90% of rape victims.

- **Rothbaum, B.O., Astin, M.C., & Marsteller, F. (2005).** Prolonged exposure versus eye movement desensitization (EMDR) for PTSD rape victims. *Journal of Traumatic Stress*, 18, 607-616.

In this NIMH funded study both treatments were effective: "An interesting potential clinical implication is that EMDR seemed to do equally well in the main despite less exposure and no homework. It will be important for future research to explore these issues.

- **Scheck, M., Schaeffer, J.A., & Gillette, C. (1998).** Brief psychological intervention with traumatized young women: The efficacy of eye movement desensitization and reprocessing. *Journal of Traumatic Stress*, 11, 25-44.

Two sessions of EMDR reduced psychological distress scores in traumatized young women and brought scores within one standard deviation of the norm.

- **Shapiro, E., Laub, B. (2015).** Early EMDR intervention following a community critical incident: A randomized clinical trial. *Journal of EMDR Practice and Research*, 9, 17-27.

At 1 week posttreatment, the scores of the immediate treatment group were significantly improved on the IES-R compared to the waitlist/delayed treatment group, who showed no improvement prior to their treatment. At 3 months follow-up, results on the IES-R were maintained and there was a significant improvement on PHQ-9 scores.

- **Shapiro, F. (1989).** Efficacy of the eye movement desensitization procedure in the treatment of traumatic memories. *Journal of Traumatic Stress Studies*, 2, 199–223.

Seminal study appeared the same year as first controlled studies of CBT treatments. Three-month follow-up indicated substantial effects on distress and behavioural reports. Marred by lack of standardized measures and the originator serving as sole therapist.

- **Soberman, G. B., Greenwald, R., & Rule, D. L. (2002).** A controlled study of eye movement desensitization and reprocessing (EMDR) for boys with conduct problems. *Journal of Aggression, Maltreatment, and Trauma*, 6, 217-236.

The addition of three sessions of EMDR resulted in large and significant reductions of memory-related distress, and problem behaviors by 2-month follow-up.

- **Taylor, S. et al. (2003).** Comparative efficacy, speed, and adverse effects of three PTSD treatments: Exposure therapy, EMDR, and relaxation training. *Journal of Consulting and Clinical Psychology*, 71, 330-338.

The only randomized study to show exposure statistically superior to EMDR on two subscales (out of 10). This study used therapist assisted “in vivo” exposure, where the therapist takes the person to previously avoided areas, in addition to imaginal exposure and one hour of daily homework (@ 50 hours). The EMDR group used only standard sessions and no homework.

- **van den Berg, D.P.G., et al. (2015).** Prolonged exposure versus eye movement desensitization and reprocessing versus waiting list for posttraumatic stress disorder in patients with a psychotic disorder: A randomized clinical trial. *JAMA Psychiatry*, 72(3):259-267.

*Standard PE and EMDR therapy protocols are effective, safe, and feasible in patients with PTSD and severe psychotic disorders, including current symptoms. Additional evaluation Indicated trauma-focused treatment was associated with significantly less exacerbation, less adverse events, and reduced revictimization compared with the WL condition: van den Berg D.P.G., et al. Trauma-focused treatment in PTSD-patients with psychosis: symptom exacerbation, adverse events, and revictimization. *Schizophrenia Bulletin*. doi: 10.1093/schbul/sbv172.*

- **van der Kolk, B., Spinazzola, J. Blaustein, M., Hopper, J. Hopper, E., Korn, D., & Simpson, W. (2007).** A randomized clinical trial of EMDR, fluoxetine and pill placebo in the treatment of PTSD: Treatment effects and long-term maintenance. *Journal of Clinical Psychiatry*, 68, 37-46.

EMDR was superior to both control conditions in the amelioration of both PTSD symptoms and depression. Upon termination of therapy, the EMDR group continued to improve while the Fluoxetine participants again became symptomatic.

- **Vaughan, K., Armstrong, M.F., Gold, R., O’Connor, N., Jenneke, W., & Tarrier, N. (1994).** A trial of eye movement desensitization compared to image habituation training and applied muscle relaxation in post-traumatic stress disorder. *Journal of Behavior Therapy & Experimental Psychiatry*, 25, 283-291.

All treatments led to significant decreases in PTSD symptoms for subjects in the treatment groups as compared to those on a waiting list, with a greater reduction in the EMDR group, particularly with respect to intrusive symptoms. In the 2-3 weeks of the study, 40-60 additional minutes of daily homework were part of the treatment in the other two conditions.

- **Wanders, F., Serra, M., & de Jongh, A. (2008).** EMDR Versus CBT for children with self-esteem and behavioral problems: A randomized controlled trial. *Journal of EMDR Practice and Research*, 2, 180-189.

Twenty-six children (average age 10.4 years) with behavioral problems were randomly assigned to receive either 4 sessions of EMDR or CBT. Both were found to have significant positive effects on behavioral and self-esteem problems, with the EMDR group showing significantly larger changes in target behaviors.

- **Wilson, S., Becker, L.A., & Tinker, R.H. (1995).** Eye movement desensitization and reprocessing (EMDR): Treatment for psychologically traumatized individuals. *Journal of Consulting and Clinical Psychology*, 63, 928-937.

Three sessions of EMDR produced clinically significant change in traumatized civilians on multiple measures.

- **Wilson, S., Becker, L.A., & Tinker, R.H. (1997).** Fifteen-month follow-up of eye movement desensitization and reprocessing (EMDR) treatment of post-traumatic stress disorder and psychological trauma. *Journal of Consulting and Clinical Psychology*, 65, 1047-1056.

Follow-up at 15 months showed maintenance of positive treatment effects with 84% remission of PTSD diagnosis.

Non-Randomized Studies

- **Aduriz, M.E., Bluthgen, C. & Knopfler, C. (2009).** Helping child flood victims using group EMDR intervention in Argentina: Treatment outcome and gender differences. *International Journal of Stress Management*. 16, 138-153.

A comprehensive group intervention with 124 children, who experienced disaster related trauma during a massive flood utilizing a one session group protocol. Significant differences were obtained and maintained at 3-month follow up.

- **Devilley, G.J., & Spence, S.H. (1999).** The relative efficacy and treatment distress of EMDR and a cognitive behavioral trauma treatment protocol in the amelioration of post-traumatic stress disorder. *Journal of Anxiety Disorders*, 13, 131-157.

The only EMDR research study that found CBT superior to EMDR. The study is marred by poor treatment delivery and higher expectations in the CBT condition. Treatment was delivered in both conditions by the developer of the CBT protocol.

- **Fernandez, I. (2007).** EMDR as treatment of post-traumatic reactions: A field study on child victims of an earthquake. *Educational and Child Psychology. Special Issue: Therapy*, 24, 65-72.

This field study explores the effectiveness of EMDR and the level of post-traumatic reactions in a post-emergency context on 22 children victims of an earthquake. The results show that EMDR contributed to the reduction or remission of PTSD symptoms and facilitated the processing of the traumatic experience.

- **Fernandez, I., Gallinari, E., & Lorenzetti, A. (2004).** A school- based EMDR intervention for children who witnessed the Pirelli building airplane crash in Milan, Italy. *Journal of Brief Therapy*, 2, 129-136.

A group intervention of EMDR was provided to 236 schoolchildren exhibiting PTSD symptoms 30 days post-incident. At four-month follow up, teachers reported that all but two children

evinced a return to normal functioning after treatment.

- **Grainger, R.D., Levin, C., Allen-Byrd, L. , Doctor, R.M. & Lee, H. (1997).** An empirical evaluation of eye movement desensitization and reprocessing (EMDR) with survivors of a natural catastrophe. *Journal of Traumatic Stress, 10*, 665-671.

A study of Hurricane Andrew survivors found significant differences on the Impact of Event Scale and subjective distress in a comparison of EMDR and non-treatment condition

- **Hensel, T. (2009).** EMDR with children and adolescents after single-incident trauma an intervention study. *Journal of EMDR Practice and Research, 3*, 2-9.

36 children and adolescents ranging in age from 1 year 9 months to 18 years 1 month were assessed at intake, post-waitlist/pretreatment, and at follow up. EMDR treatment resulted in significant improvement, demonstrating that children younger than 4 years of age showed the same benefit as the school-age children.

- **Jarero, I., & Artigas, L. (2010).** The EMDR integrative group treatment protocol: Application with adults during ongoing geopolitical crisis. *Journal of EMDR Practice and Research, 4*, 148-155.

In this study, the EMDR-IGTP was applied during three consecutive days to a group of 20 adults during ongoing geopolitical crisis in a Central American country in 2009. . . Changes on the IES were maintained at 14 weeks follow-up even though participants were still exposed to ongoing crisis.

- **Jarero, I., Artigas, L., & Hartung, J. (2006).** EMDR integrative group treatment protocol: A post-disaster trauma intervention for children and adults. *Traumatology, 12*, 121-129.

A study of 200 children treated with a group protocol after a flood in Mexico indicates that one session of treatment reduced trauma symptoms from the severe range to low (subclinical) levels of distress. Data from successful treatment at other disaster sites are also reported.

- **Jarero, I., Artigas, L., Lopez-Lena, M. (2008).** The EMDR integrative group treatment protocol: Application with child victims of mass disaster. *Journal of EMDR Practice and Research, 2*, 97-105.

In this study the EMDR-IGTP was used with 16 bereaved children after a human provoked disaster in the Mexican State of Coahuila in 2006. Results showed a significant decrease in scores on the Child's Reaction to Traumatic Events Scale that was maintained at 3-month follow-up.

- **Jarero, I. & Uribe, S. (2011).** The EMDR protocol for recent critical incidents: Brief report of an application in a human massacre situation. *Journal of EMDR Practice and Research, 5*, 156-165.

Each individual client session lasted between 90 and 120 minutes. Results showed that one session of EMDR-PRECI produced significant improvement on self-report measures of posttraumatic stress and PTSD symptoms for both the immediate treatment and waitlist/delayed treatment groups.

- **Jarero, I. & Uribe, S. (2012).** The EMDR protocol for recent critical incidents: Follow-up report of an application in a human massacre situation. *Journal of EMDR Practice and Research*, 6, 50-61.

Follow-up scores showed that the original treatment results were maintained, with a further significant reduction of self-reported symptoms of posttraumatic stress and PTSD between posttreatment and follow-up. . . . [S]cores of all participants were far below PTSD cutoff level

- **Konuk, E., Knipe, J., Eke, I., Yuksek, H., Yurtsever, A., & Ostep, S. (2006).** The effects of EMDR therapy on post-traumatic stress disorder in survivors of the 1999 Marmara, Turkey, earthquake. *International Journal of Stress Management*, 13, 291-308.

Data reported on a representative sample of 1500 earthquake victims indicated that five sessions of EMDR successfully eliminated PTSD in 92.7% of those treated, with a reduction of symptoms in the remaining participants.

- **McLay, R. N., Webb-Murphy, J. A., Fesperman, S. F., Delaney, E. M., Gerard, S. K., Roesch, S. C., Nebeker, B. J., Pandzic, I., Vishnyak, E. A., & Johnston, S. L. (2016, March 10).** Outcomes from eye movement desensitization and reprocessing in active-duty service members with posttraumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy*. Advance online publication. <http://dx.doi.org/10.1037/tra0000120>

Results indicated that patients receiving EMDR had significantly fewer therapy sessions over 10 weeks but had significantly greater gains in their PCL–M scores than did individuals not receiving EMDR.

- **Puffer, M.; Greenwald, R. & Elrod, D. (1997).** A single session EMDR study with twenty traumatized children and adolescents. *Traumatology-e*, 3(2), Article 6.

In this delayed treatment comparison, over half of the participants moved from clinical to normal levels on the Impact of Events Scale, and all but 3 showed at least partial symptom relief on several measures at 1-3 m following a single EMDR session.

- **Ribchester, T., Yule, W., & Duncan, A. (2010).** EMDR for childhood PTSD after road traffic accidents: Attentional, memory, and attributional processes. *Journal of EMDR Practice and Research*, 4(4), 138-147.

EMDR was used with 11 children who developed posttraumatic stress disorder (PTSD) after road traffic accidents. All improved such that none met criteria for PTSD on standardized

assessments after an average of only 2.4 sessions. . . Treatment was associated with a significant trauma-specific reduction in attentional bias on the modified Stroop task, with results apparent both immediately after therapy and at follow-up.

- **Russell, M.C., Silver, S.M., Rogers, S., & Darnell, J. (2007).** Responding to an identified need: A joint Department of Defense-Department of Veterans Affairs training program in eye movement desensitization and reprocessing (EMDR) for clinicians providing trauma services. *International Journal of Stress Management*, 14, 61-71.

72 active-duty military personnel were treated with EMDR therapy by nine different therapists in actual clinic settings. Results indicated that “the disturbance associated with the targeted traumatic memories had been largely eliminated and a new more positive perspective had developed. These changes were corroborated with the IES-R and BDI scores falling from the severe range to the mild or subclinical range.” Average treatment time: 8.50 sessions if wounded and 3.82 sessions if nonwounded.

- **Schubert, S.J., Lee, C.W., de Araujo, G., Butler, S.R., Taylor, G. & Drummond, P. (2016).** The effectiveness of eye movement desensitization and reprocessing (EMDR) therapy to treat symptoms following trauma in Timor Leste. *Journal of Traumatic Stress*.

These findings suggest that benefits can be achieved with EMDR therapy for decreasing PTSD symptoms in a post-war, cross-cultural setting in a relatively short period (on average 4 treatment sessions over 13 days).

- **Silver, S.M., Brooks, A., & Obenchain, J. (1995).** Eye movement desensitization and reprocessing treatment of Vietnam war veterans with PTSD: Comparative effects with biofeedback and relaxation training. *Journal of Traumatic Stress*, 8, 337-342.

The analysis of an inpatient veterans’ PTSD program (n=100) found EMDR to be vastly superior to biofeedback and relaxation training on seven of eight measures.

- **Silver, S.M., Rogers, S., Knipe, J., & Colelli, G. (2005).** EMDR therapy following the 9/11 terrorist attacks: A community-based intervention project in New York City. *International Journal of Stress Management*.

Clients made highly significant positive gains on a range of outcome variables, including validated psychometrics and self-report scales. Analyses of the data indicate that EMDR is a useful treatment intervention both in the immediate aftermath of disaster as well as later.

- **Solomon, R.M. & Kaufman, T.E. (2002).** A peer support workshop for the treatment of traumatic stress of railroad personnel: Contributions of eye movement desensitization and reprocessing (EMDR). *Journal of Brief Therapy*, 2, 27-33.

60 railroad employees who had experienced fatal grade accident crossing accidents were evaluated for workshop outcomes, and for the additive effects of EMDR treatment. Although

the workshop was successful, in this setting, the addition of a short session of EMDR (5-40 minutes) led to significantly lower, sub clinical, scores which further decreased at follow up

- **Sprang, G. (2001).** The use of eye movement desensitization and reprocessing (EMDR) in the treatment of traumatic stress and complicated mourning: Psychological and behavioral outcomes. *Research on Social Work Practice, 11*, 300-320.

In a multi-site study, EMDR significantly reduced symptoms more often than the CBT treatment on behavioral measures, and on four of five psychosocial measures. EMDR was more efficient, inducing change at an earlier stage and requiring fewer sessions.

- **Wadaa, N. N., Zaharim, N. M., & Alqashan, H. F. (2010).** The use of EMDR in treatment of traumatized Iraqi children. *Digest of Middle East Studies, 19*, 26-36.

Our findings are consistent with the conclusion . . . that EMDR is effective for civilian PTSD, and it applies its treatment in a user-friendly manner . . . The results of the study demonstrated the effectiveness of EMDR in the treatment of PTSD in the experimental group compared to the control group.

- **Zaghrou-Hodali, M., Alissa, F. & Dodgson, P.W. (2008).** Building resilience and dismantling fear: EMDR group protocol with children in an area of ongoing trauma. *Journal of EMDR Practice and Research, 2*, 106-113.

Results indicate that the EMDR approach can be effective in a group setting, and in an acute situation, both in reducing symptoms of posttraumatic and peritraumatic stress and in “inoculation” or building resilience in a setting of ongoing conflict and trauma.

Adaptive Information Processing and EMDR Procedures

The Adaptive Information Processing model (Shapiro, 2001, 2002, 2007) is used to explain EMDR’s clinical effects and guide clinical practice. This model is not linked to any specific neurobiological mechanism since the field of neurobiology is as yet unable to determine this in any form of psychotherapy (nor of most medications). This section includes literature to provide an overview of the model and procedures, as well as selected research and case reports that demonstrate the predictive value of the model in the treatment of life experiences that appear to underlie a variety of clinical complaints.

- **Afifi, T.O., Mota, N.P., Dasiewicz, P., MacMillan, H.L. & Sareen, J. (2012).** Physical punishment and mental disorders: Results from a nationally representative US sample. *Pediatrics, 130*, 184-192.

Harsh physical punishment [i.e., pushing, grabbing, shoving, slapping, hitting] in the absence of [more severe] child maltreatment is associated with mood disorders, anxiety disorders, substance abuse/dependence, and personality disorders in a general population sample.

- **Allon, M. (2015).** EMDR group therapy with women who were sexually assaulted in the Congo. *Journal of EMDR Practice and Research*, 9, 28-34.

Rape victims were successfully treated within three sessions using both individual and group protocols. They reported the simultaneous remission of back and abdominal pain. These processing results are consistent with the reported remission of PLP with EMDR therapy.

- **Arseneault, L., Cannon, M, Fisher, H.L. Polanczyk, G. Moffitt, T.E. & Caspi, A. (2011).** Childhood trauma and children's emerging psychotic symptoms: A genetically sensitive longitudinal cohort study. *Am J Psychiatry*, 168, 65–72.

Trauma characterized by intention to harm is associated with children's reports of psychotic symptoms. Clinicians working with children who report early symptoms of psychosis should inquire about traumatic events such as maltreatment and bullying.

- **Bae, H., Kim, D. & Park, Y.C. (2008).** Eye movement desensitization and reprocessing for adolescent depression. *Psychiatry Investigation*, 5, 60-65.

Processing of etiological disturbing memories, triggers and templates resulted in complete remission of Major Depressive Disorder in two teenagers. Treatment duration was 3-7 sessions and effects were maintained at follow-up.

- **Behnam Moghadam, M., Alamdari, A.K., Behnam Moghadam, A. & Darban, F. (2015).** Effect of EMDR on depression in patients with myocardial infarction *Global Journal of Health Science*, 7, 258-262.

*In this randomized study, the mean depression level in experimental group significantly decreased following the intervention. These changes were significantly greater compared to the control group. Conclusion: "EMDR is an effective, useful, efficient, and non-invasive method for treatment and reducing depression in patients with MI." A 12-month follow-up reported maintenance of treatment effects: Behnam, M. M., Behnam, M. A., & Salehian, T. (2015). Efficacy of eye movement desensitization and reprocessing (EMDR) on depression in patients with myocardial infarction (MI) in a 12-month follow up. *Iranian Journal of Critical Care Nursing*, 7, 221-226.*

- **Brown, S. & Shapiro, F. (2006).** EMDR in the treatment of borderline personality disorder. *Clinical Case Studies*, 5, 403-420.

20 EMDR sessions that focused on reprocessing the memories seemingly at the foundation of the pathology, along with triggers and future templates resulted in a complete remission of BPD, including symptoms of affect dysregulation, as measured on the Inventory of Altered Self Capacities.

- **Brown, K. W., McGoldrick, T., & Buchanan, R. (1997).** Body dysmorphic disorder: Seven cases treated with eye movement desensitization and reprocessing. *Behavioural and Cognitive*

Psychotherapy, 25, 203–207.

Seven consecutive cases were treated with up to three sessions of EMDR. Complete remission of BDD symptoms were reported in five cases with effects maintained at one- year follow-up.

- **Doering, S., Ohlmeier, M. C., Jongh, A., Hofmann, A., & Bisping, V. (2013).** Efficacy of a trauma-focused treatment approach for dental phobia: a randomized clinical trial. *European Journal of Oral Sciences*, 121, 584-593.

Three sessions of EMDR therapy memory processing resulted in remission of dental phobia. After 1 yr, 83.3% of the patients were in regular dental treatment (d = 3.20). The findings suggest that therapy aimed at processing memories of past dental events can be helpful for patients with dental phobia.

- **de Roos, C., Veenstra, A.C, et al. (2010).** Treatment of chronic phantom limb pain (PLP) using a trauma-focused psychological approach. *Pain Research and Management*, 15, 65-71.

10 consecutive cases of phantom limb pain were treated with EMDR resulting in the reduction or elimination of pain in all but two cases. Results were maintained at 2.8-year follow-up.

- **Faretta, E. (2013).** EMDR and cognitive behavioral therapy in the treatment of panic disorder: A comparison. *Journal of EMDR Practice and Research*, 7, 121-133.

As predicted by AIP, the processing of etiological events, triggers and memory templates was sufficient to alleviate the diagnosis without the use of treatment specific homework in contrast to the CBT group. In this study, there was “a continuing decrease in frequency of panic attacks for participants with PD or PDA in the EMDR condition at follow-up that was significantly greater than that found in the CBT treatment group.”

- **Felitti, V. J., et al. (1998).** Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The adverse childhood experiences (ACE) study. *American Journal of Preventive Medicine*, 14, 245–258.

We found a strong dose response relationship between the breadth of exposure to abuse or household dysfunction during childhood and multiple risk factors for several of the leading causes of death in adults.

- **Fernandez, I., & Faretta, E. (2007).** EMDR in the treatment of panic disorder with agoraphobia. *Clinical Case Studies*, 6, 44-63.

As predicted by AIP, the processing of etiological events, triggers and memory templates was sufficient to alleviate the diagnosis without the use of therapist-assisted in vivo exposure.

- **Gauvreau, P. & Bouchard, S. (2008).** Preliminary evidence for the efficacy of EMDR in treating generalized anxiety disorder. *Journal of EMDR Practice and Research*, 2, 26- 40.

Four subjects were evaluated using a single case design with multiple baselines. Results indicate that subsequent to targeting the experiential contributors, at posttreatment and at 2 months follow-up, all four participants no longer presented with GAD diagnosis.

- **Gold, S. D., Marx, B. P., Soler-Baillo, J. M., & Sloan, D. M. (2005).** Is life stress more traumatic than traumatic stress? *Journal of Anxiety Disorders*, 19, 687-698.

[The non-Criterion A] group reported significantly greater severity of PTSD symptomatology than those who reported a Criterion A1 PTSD event. In addition, significantly more people in the DSM trauma-incongruent group met criteria for PTSD than those in the DSM trauma-congruent group.

- **Heim, Plotsky & Nemeroff (2004).** Importance of studying the contributions of early adverse experience to neurobiological findings in depression. *Neuropsychopharmacology*, 29, 641–648.

The available data suggest that (1) early adverse experience contributes to the pathophysiology of depression, (2) there are neurobiologically different subtypes of depression depending on the presence or absence of early adverse experience, likely having confounded previous research on the neurobiology of depression, and (3) early adverse experience likely influences treatment response in depression.

- **Heins et al. (2011).** Childhood trauma and psychosis: a case-control and case-sibling comparison across different levels of genetic liability, psychopathology, and type of trauma. *Am J Psychiatry*, 168, 1286-1294.

Discordance in psychotic illness across related individuals can be traced to differential exposure to trauma. The association between trauma and psychosis is apparent across different levels of illness and vulnerability to psychotic disorder, suggesting true association rather than reporting bias, reverse causality, or passive gene-environment correlation.

- **Madrid, A., Skolek, S., & Shapiro, F. (2006).** Repairing failures in bonding through EMDR. *Clinical Case Studies*, 5, 271-286.

EMDR processing of experiential contributors to bonding disruption, in addition to current triggers, and a memory template of an alternative/problem free pregnancy and birth resulted in the repair of maternal bonding, analogous to the positive findings with the repair of disrupted attachment.

- **McGoldrick, T., Begum, M. & Brown, K.W. (2008).** EMDR and olfactory reference syndrome: A case series. *Journal of EMDR Practice and Research* 2, 63-68.

EMDR treatment of four consecutive cases of ORS whose pathological symptoms had endured for 8–48 years resulted in a complete resolution of symptoms in all four cases, which was

maintained at follow-up.

- **Mol, S. S. L., Arntz, A., Metsemakers, J. F. M., Dinant, G., Vilters-Van Montfort, P. A. P., & Knottnerus, A. (2005).** Symptoms of post-traumatic stress disorder after non-traumatic events: Evidence from an open population study. *British Journal of Psychiatry*, 186, 494–499.

Supports a basic tenet of the Adaptive Information Processing model that “Life events can generate at least as many PTSD symptoms as traumatic events.” In a survey of 832 people, for events from the past 30 years the PTSD scores were higher after life events than after traumatic events.

- **Nazari, H., Momeni, N., Jariani, M., & Tarrahi, M. J. (2011).** Comparison of eye movement desensitization and reprocessing with citalopram in treatment of obsessive-compulsive disorder. *International Journal of Psychiatry in Clinical Practice*, 15, 270-274.

There was significant difference between the mean Yale–Brown scores of the two groups after treatment and EMDR was more effective than citalopram in improvement of OCD signs.

- **Obradovic, J., Bush, N.R., Stamperdahl, J., Adler, N.E. & Boyce, W.T. (2010).** Biological sensitivity to context: The interactive effects of stress reactivity and family adversity on socioemotional behavior and school readiness. *Child Development*, 1, 270–289.

A substantive body of work has established that environmental adversity can have a deleterious effect on children’s functioning” “Exposure to adverse, stressful events . . .has been linked to socioemotional behavior problems and cognitive deficits.

- **Perkins, B.R. & Rouanzoin, C.C. (2002).** A critical evaluation of current views regarding eye movement desensitization and reprocessing (EMDR): Clarifying points of confusion. *Journal of Clinical Psychology*, 58, 77-97.

Reviews common errors and misperceptions of the procedures, research, and theory.

- **Raboni, M.R., Tufik, S., & Suchecki, D. (2006).** Treatment of PTSD by eye movement desensitization and reprocessing improves sleep quality, quality of life and perception of stress. *Annals of the New York Academy of Science*, 1071, 508-513.

Specifically citing the hypothesis that EMDR induces processing effects similar to REM sleep (see also Stickgold, 2002, 2008), polysomnograms indicated a change in sleep patterns post treatment, and improvement on all measures including anxiety, depression, and quality of life after a mean of five sessions.

- **Ray, A. L. & Zbik, A. (2001).** Cognitive behavioral therapies and beyond. In C. D. Tollison, J. R. Satterhwaite, & J. W. Tollison (Eds.) *Practical Pain Management* (3rd ed.; pp. 189-208). Philadelphia: Lippincott.

The authors note that the application of EMDR guided by the Adaptive Information Processing

model appears to afford benefits to chronic pain patients not found in other treatments.

- **Ricci, R. J., Clayton, C. A., & Shapiro, F. (2006).** Some effects of EMDR treatment with previously abused child molesters: Theoretical reviews and preliminary findings. *Journal of Forensic Psychiatry and Psychology*, 17, 538-562.

As predicted by the Adaptive Information Processing model the EMDR treatment of the molesters' own childhood victimization resulted in a decrease in deviant arousal as measured by the plethysmograph, a decrease in sexual thoughts, and increased victim empathy. Effects maintained at one year follow up.

- **Robinson, J. S. & Larson, C. 2010.** Are traumatic events necessary to elicit symptoms of posttraumatic stress? *Psychological Trauma: Theory, Research, Practice, and Policy*, 2, 71-76.

Research data indicated similar levels of posttrauma symptom severity for all three symptom clusters among people who had endorsed the experience of only a traumatic type event and people who had reported the experience of only stressful negative life events [e.g., loss of job, problems with school or work, or change in financial status].

- **Russell, M. (2008).** Treating traumatic amputation-related phantom limb pain: a case study utilizing eye movement desensitization and reprocessing (EMDR) within the armed services. *Clinical Case Studies*, 7, 136-153.

Since September 2006, over 725 service-members from the global war on terrorism have survived combat-related traumatic amputations that often result in phantom limb pain (PLP) syndrome. . . . Four sessions of Eye Movement Desensitization and Reprocessing (EMDR) led to elimination of PLP, and a significant reduction in PTSD, depression, and phantom limb tingling sensations.

- **Schneider, J., Hofmann, A., Rost, C., & Shapiro, F. (2008).** EMDR in the treatment of chronic phantom limb pain. *Pain Medicine*, 9, 76-82.

As predicted by the Adaptive Information Processing model the EMDR treatment of the event involving the limb loss, and the stored memories of the pain sensations, resulted a decrease or elimination of the phantom limb pain which was maintained at 1-year follow-up.

- **Schneider, J., Hofmann, A., Rost, C., & Shapiro, F. (2007).** EMDR and phantom limb pain: Case study, theoretical implications, and treatment guidelines. *Journal of EMDR Practice and Research*, 1, 31-45.

Detailed presentation of case treated by EMDR that resulted in complete elimination of PTSD, depression and phantom limb pain with effects maintained at 18-month follow-up.

- **Shapiro, F. (2001).** *Eye movement desensitization and reprocessing: Basic principles, protocols and procedures (2nd ed.)*. New York: Guilford Press.

EMDR is an eight-phase psychotherapy with standardized procedures and protocols that are all believed to contribute to therapeutic effect. This text provides description and clinical transcripts and an elucidation of the guiding Adaptive Information Processing model.

- **Shapiro, F. (2002).** (Ed.). *EMDR as an integrative psychotherapy approach: Experts of diverse orientations explore the paradigm prism*. Washington, DC: American Psychological Association Books.

EMDR is an integrative approach distinct from other forms of psychotherapy. Experts of the major psychotherapy orientations identify and highlight various procedural elements.

- **Shapiro, F. (2007).** EMDR, adaptive information processing, and case conceptualization. *Journal of EMDR Practice and Research*, 1, 68-87.

Overview of EMDR treatment based upon an Adaptive Information Processing case conceptualization. Early life experiences are viewed as the basis of pathology and used as targets for processing. The three-pronged protocol includes processing of the past events that have set the foundation for the pathology, the current triggers, and templates for appropriate future functioning to address skill and developmental deficits.

- **Shapiro, F. (2006).** *EMDR and new notes on adaptive information processing: Case formulation principles, scripts and worksheets*. Camden, CT: EMDR Humanitarian Assistance Programs.

Overview of Adaptive Information Processing model, including how the principles are reflected in the procedures, phases and clinical applications of EMDR. Comprehensive worksheets for client assessment, case formulation, and treatment as well as scripts for various procedures.

- **Shapiro, F. (2012).** EMDR therapy: An overview of current and future research. *European Review of Applied Psychology*, 62, 193-195.

Research findings indicate that EMDR therapy and TF-CBT are based on different mechanisms of action in that EMDR therapy does not necessitate daily homework, sustained arousal or detailed descriptions of the event, and appears to take fewer sessions. EMDR is guided by the adaptive information processing model, which posits a wide range of adverse life experiences as the basis of pathology.

- **Shapiro, F. (2014).** The role of eye movement desensitization & reprocessing (EMDR) therapy in medicine: Addressing the psychological and physical symptoms stemming from adverse life experiences. *The Permanente Journal*, 18, 71-77.

An overview of the substantial body of research demonstrating that adverse life experiences contribute to both psychological and biomedical pathology, as well as the research demonstrating the clinical effects of EMDR therapy as guided by the Adaptive Information Processing model.

- **Shapiro, F., Kaslow, F., & Maxfield, L. (Eds.) (2007).** *Handbook of EMDR and Family Therapy Processes*. Hoboken, NJ: Wiley.

Using an Adaptive Information Processing conceptualization a wide range of family problems and impasses can be addressed through the integration of EMDR and family therapy techniques. Family therapy models are also useful for identifying the targets in need of processing for those engaged in individual therapy.

- **Simhandl, C., Radua, J., König, B., & Amann, B. L. (2014).** The prevalence and effect of life Events in 222 bipolar I and II patients: A prospective, naturalistic 4 year follow-up study. *Journal of Affective Disorders*.

Our data suggest a high and continuous number of life events prior to affective episodes. Life events after the index episode worsened the course of bipolar I patients with more depressive episodes. This underlines the importance of detection and treatment of emerging life events.

- **Solomon, R. M. & Shapiro, F, (2008).** EMDR and the adaptive information processing model: Potential mechanisms of change. *Journal of EMDR Practice and Research*, 2, 315-325.

This article provides a brief overview of some of the major precepts of the Adaptive Information Processing model, a comparison and contrast to extinction-based information processing models and treatment and a discussion of a variety of mechanisms of action.

- **Teicher, M.H. . Samson, J.A., Sheu, Y-S, Polcari, A. & McGreenery, C.E. (2010).** Hurtful words: Association of exposure to peer verbal abuse with elevated psychiatric symptom scores and corpus callosum abnormalities. *Am J Psychiatry*, 167, 1464 – 1471.

These findings parallel results of previous reports of psychopathology associated with childhood exposure to parental verbal abuse and support the hypothesis that exposure to peer verbal abuse is an aversive stimulus associated with greater symptom ratings and meaningful alterations in brain structure.

- **Uribe, M. E. R., & Ramirez, E. O. L. (2006).** The effect of EMDR therapy on the negative information processing on patients who suffer depression. *Revista Electrónica de Motivación y Emoción (REME)*, 9, 23-24.

The study evaluated the impact of EMDR treatment on bias mechanisms in depressed subjects in regard to negative emotional valence evaluation. “The results indicated that it generated important cognitive emotional changes in such mechanisms.” Priming tests indicated changes in the negative valence evaluation of emotional information indicative of recovery with

decreased reaction times in the neutral and positive stimuli processing.

- **van den Berg, D.P.G. & van den Gaag, M. (2012).** Treating trauma in psychosis with EMDR: A pilot study. *Journal of Behavior Therapy & Experimental Psychiatry*, 43, 664-671.

This pilot study shows that a short EMDR therapy is effective and safe in the treatment of PTSD in subjects with a psychotic disorder. Treatment of PTSD has a positive effect on auditory verbal hallucinations, delusions, anxiety symptoms, depression symptoms, and self-esteem.

- **Varese, F., Smeets, F., Drukker, M., Lieverse, R., Lataster, T., Viechtbauer, W., et al. (2012).** Childhood adversities increase the risk of psychosis: A meta-analysis of patient-control, prospective- and cross-sectional cohort studies. *Schizophrenia Bulletin*, 38 (4), 661-671.

These findings indicate that childhood adversity is strongly associated with increased risk for psychosis.

- **Wesselmann, D. & Potter, A. E. (2009).** Change in adult attachment status following treatment with EMDR: Three case studies. *Journal of EMDR Practice and Research*, 3, 178-191.

Subsequent to EMDR treatment “all three patients made positive changes in attachment status as measured by the [Adult Attachment Inventory], and all three reported positive changes in emotions and relationships.

- **Wilensky, M. (2006).** Eye movement desensitization and reprocessing (EMDR) as a treatment for phantom limb pain. *Journal of Brief Therapy*, 5, 31-44.

Five consecutive cases of phantom limb pain were treated with EMDR. Four of the five clients completed the prescribed treatment and reported that pain was completely eliminated, or reduced to a negligible level. . . The standard EMDR treatment protocol was used to target the accident that caused the amputation, and other related events.

Mechanism of Action

EMDR contains many procedures and elements that contribute to treatment effects. While the methodology used in EMDR has been extensively validated (see above), questions still remain regarding mechanism of action. However, since EMDR achieves clinical effects without the need for homework, or the prolonged focus used in exposure therapies, attention has been paid to the possible neurobiological processes that might be evoked. Although the eye movements (and other dual attention stimulation) comprise only one procedural element, this element has come under greatest scrutiny. Randomized controlled studies evaluating mechanism of action of the eye movement component follow this section.

- **de Jongh, A., Ernst, R., Marques, L., & Hornsveld, H. (2013).** The impact of eye movements and tones on disturbing memories of patients with PTSD and other mental disorders. *Journal of Behavior Therapy and Experimental Psychiatry*, 44, 447–483.

The findings provide further evidence for the value of employing eye movements in EMDR treatments. The results also support the notion that EMDR is a suitable option for resolving disturbing memories underlying a broader range of mental health problems than PTSD alone.

- **El Khoury-Malhame, M. et al. (2011).** Attentional bias in post-traumatic stress disorder diminishes after symptom amelioration. *Behaviour Research and Therapy* 49, 796-801.

Attentional bias toward aversive cues in PTSD has been hypothesized as being part of the dysfunction causing etiology and maintenance of PTSD. The aim of the present study was to investigate the cognitive strategy underlying attentional bias in PTSD and whether normal cognitive processing is restored after a treatment suppressing core PTSD symptoms.” An average of 4.1 EMDR sessions resulted in remission of PTSD. Post treatment “similarly to controls, EMDR treated patients who were symptom free had null e-Stroop and disengagement indices.

- **Elofsson, U.O.E., von Scheele, B., Theorell, T., & Sondergaard, H.P. (2008).** Physiological correlates of eye movement desensitization and reprocessing. *Journal of Anxiety Disorders*, 22, 622-634.

Changes in heart rate, skin conductance and LF/HF-ratio, finger temperature, breathing frequency, carbon dioxide and oxygen levels were documented during the eye movement condition. It was concluded the “eye movements during EMDR activate cholinergic and inhibit sympathetic systems. The reactivity has similarities with the pattern during REM sleep.

- **Hornsveld, H. K., Landwehr, F., Stein, W., Stomp, M., Smeets, S., & van den Hout, M. A. (2010).** Emotionality of loss-related memories is reduced after recall plus eye movements but not after recall plus music or recall only. *Journal of EMDR Practice and Research*, 4, 106-112.

Recall-plus-music was added to investigate whether reductions in emotionality are associated with relaxation. . . Participants reported a greater decline in emotionality and concentration after eye movements in comparison to recall-only and recall-with-music. It is concluded that eye movements are effective when negative memories pertain to loss and grief.

- **Kapoula Z, Yang Q, Bonnet A, Bourtoire P, & Sandretto J (2010).** EMDR Effects on Pursuit Eye Movements. *PLoS ONE* 5(5): e10762. doi:10.1371/journal.pone.0010762

EMDR treatment of autobiographic worries causing moderate distress resulted in an “increase in the smoothness of pursuit [which] presumably reflects an improvement in the use of visual attention needed to follow the target accurately. Perhaps EMDR reduces distress

thereby activating a cholinergic effect known to improve ocular pursuit.

- **Kristjánsdóttir, K. & Lee, C. M. (2011).** A comparison of visual versus auditory concurrent tasks on reducing the distress and vividness of aversive autobiographical memories. *Journal of EMDR Practice and Research*, 5, 34-41.

Results showed that vividness and emotionality ratings of the memory decreased significantly after eye movement and counting, and that eye movement produced the greatest benefit. Furthermore, eye movement facilitated greater decrease in vividness irrespective of the modality of the memory. Although this is not consistent with the hypothesis from a working memory model of mode-specific effects, it is consistent with a central executive explanation.

- **Lee, C.W., Taylor, G., & Drummond, P.D. (2006).** The active ingredient in EMDR: Is it traditional exposure or dual focus of attention? *Clinical Psychology and Psychotherapy*, 13, 97-107.

This study tested whether the content of participants' responses during EMDR is similar to that thought to be effective for traditional exposure treatments (reliving), or is more consistent with distancing which would be expected given Shapiro's proposal of dual focus of attention. Greatest improvement on a measure of PTSD symptoms occurred when the participant processed the trauma in a more detached manner, which indicates the underlying mechanisms of EMDR and exposure therapy are different.

- **Leer, A., Engelhard, I. M., & van den Hout, M. A. (2014).** How eye movements in EMDR work: changes in memory vividness and emotionality. *Journal of behavior therapy and experimental psychiatry*, 45 (3), 396-401.

This study provides corroborating evidence that EM during recall causes reductions in memory vividness and emotionality at a delayed post-test and that the magnitude of these effects is related to intervention duration.

- **Lilley, S.A., Andrade, J., Graham Turpin, G., Sabin-Farrell, R., & Holmes, E.A. (2009).** Visuospatial working memory interference with recollections of trauma. *British Journal of Clinical Psychology*, 48, 309–321.

Tested patients awaiting PTSD treatment and demonstrated that the eye movement condition had a significant effect on vividness of trauma memory and emotionality compared to counting and exposure only. In addition, "the counting task had no effect on vividness compared to exposure only, suggesting that the eye-movement task had a specific effect rather than serving as a general distractor" (p. 317).

- **MacCulloch, M. J., & Feldman, P. (1996).** Eye movement desensitization treatment utilizes the positive visceral element of the investigatory reflex to inhibit the memories of post-traumatic stress disorder: A theoretical analysis. *British Journal of Psychiatry*, 169, 571–579.

One of a variety of articles positing an orienting response as a contributing element (see Shapiro, 2001 for comprehensive examination of theories and suggested research parameters). This theory has received controlled research support (Barrowcliff et al., 2003, 2004).

- **Propper, R., Pierce, J.P., Geisler, M.W., Christman, S.D., & Bellorado, N. (2007).** Effect of bilateral eye movements on frontal interhemispheric gamma EEG coherence: Implications for EMDR therapy. *Journal of Nervous and Mental Disease*, 195, 785-788.

Specifically, the EM manipulation used in the present study, reported previously to facilitate episodic memory, resulted in decreased interhemispheric EEG coherence in anterior prefrontal cortex. Because the gamma band includes the 40 Hz wave that may indicate the active binding of information during the consolidation of long-term memory storage (e.g., Cahn and Polich, 2006), it is particularly notable that the changes in coherence we found are in this band. With regard to PTSD symptoms, it may be that by changing interhemispheric coherence in frontal areas, the EMs used in EMDR foster consolidation of traumatic memories, thereby decreasing the memory intrusions found in this disorder.

- **Rogers, S., & Silver, S. M. (2002).** Is EMDR an exposure therapy? A review of trauma protocols. *Journal of Clinical Psychology*, 58,43-59.

Theoretical, clinical, and procedural differences referencing two decades of CBT and EMDR research.

- **Rogers, S., Silver, S., Goss, J., Obenchain, J., Willis, A., & Whitney, R. (1999).** A single session, controlled group study of flooding and eye movement desensitization and reprocessing in treating posttraumatic stress disorder among Vietnam war veterans: Preliminary data. *Journal of Anxiety Disorders*, 13, 119–130.

This study was designed as primarily a process report to compare EMDR and exposure therapy. A different recovery pattern was observed with the EMDR group demonstrating a more rapid decline in self-reported distress.

- **Sack, M., Hofmann, A., Wizelman, L., & Lempa, W. (2008).** Psychophysiological changes during EMDR and treatment outcome. *Journal of EMDR Practice and Research*, 2, 239-246

During-session changes in autonomic tone were investigated in 10 patients suffering from single-trauma PTSD. Results indicate that information processing during EMDR is followed by during-session decrease in psychophysiological activity, reduced subjective disturbance and reduced stress reactivity to traumatic memory.

- **Sack, M., Lempa, W. Steinmetz, A., Lamprecht, F. & Hofmann, A. (2008).** Alterations in autonomic tone during trauma exposure using eye movement desensitization and reprocessing (EMDR) – results of a preliminary investigation. *Journal of Anxiety Disorders*, 22, 1264-1271.

The psycho-physiological correlates of EMDR were investigated during treatment sessions of trauma patients. The initiation of the eye movements sets resulted in immediate changes that indicated a pronounced de-arousal.

- **Servan-Schreiber, D., Schooler, J., Dew, M.A., Carter, C., & Bartone, P. (2006).** EMDR for PTSD: A pilot blinded, randomized study of stimulation type. *Psychotherapy and Psychosomatics*, 75, 290-297.

Twenty-one patients with single-event PTSD (average IES: 49.5) received three consecutive sessions of EMDR with three different types of auditory and kinesthetic stimulation. All were clinically useful. However, alternating stimulation appeared to confer an additional benefit to the EMDR procedure.

- **Stickgold, R. (2002).** EMDR: A putative neurobiological mechanism of action. *Journal of Clinical Psychology*, 58, 61-75.
- **Stickgold, R. (2008).** Sleep-dependent memory processing and EMDR action. *Journal of EMDR Practice and Research*, 2, 289-299.

Comprehensive explanations of mechanisms and the potential links to the processes that occur in REM sleep. Controlled studies have evaluated these theories (see next section; Christman et al., 2003; Kuiken et al. 2001-2002).

- **Suzuki, A., et al. (2004).** Memory reconsolidation and extinction have distinct temporal and biochemical signatures. *Journal of Neuroscience*, 24, 4787– 4795.

The article explores the differences between memory reconsolidation and extinction. This new area of investigation is worthy of additional attention. Reconsolidation may prove to be the underlying mechanism of EMDR, as opposed to extinction caused by prolonged exposure therapies. Memory reconsolidation after retrieval may be used to update or integrate new information into long-term memories . . . Brief exposure ... seems to trigger a second wave of memory consolidation (reconsolidation), whereas prolonged exposure . . . leads to the formation of a new memory that competes with the original memory (extinction).

- **van den Hout, M., et al. (2011).** EMDR: Tones inferior to eye movements in the EMDR treatment of PTSD. *Behaviour Research and Therapy*, 50, 275-79.

EMs outperformed tones while it remained unclear if tones add to recall only. . . EMs were superior to tones in reducing the emotionality and vividness of trauma memories. [I]n contrast to EMs, tones hardly tax working memory and induce a smaller reduction in emotionality and vividness of aversive memories. Interestingly, patients' preferences did not follow this pattern: the perceived effectiveness was higher for tones than for EMs. . . . Clearly, the superior effects of EMs on emotionality and vividness of trauma memories were not due to demand

characteristics.

- **Wilson, D., Silver, S. M., Covi, W., & Foster, S. (1996).** Eye movement desensitization and reprocessing: Effectiveness and autonomic correlates. *Journal of Behaviour Therapy and Experimental Psychiatry*, 27, 219–229.
Study involving biofeedback equipment has supported the hypothesis that the parasympathetic system is activated by finding that eye movements appeared to cause a compelled relaxation response. More rigorous research with trauma populations is needed.

Randomized Studies of Hypotheses Regarding Eye Movements

Numerous memory researchers have evaluated the eye movements used in EMDR therapy. A recent meta-analysis of the eye movement research has reported positive effects (Lee & Cuijpers, 2013) in both clinical and laboratory trials (see above). It is hypothesized that a number of mechanisms interact synergistically. The following studies have tested specific hypotheses regarding mechanism of action and found a direct effect on emotional arousal, imagery vividness, attentional flexibility, retrieval, distancing and memory association.

- **Andrade, J., Kavanagh, D., & Baddeley, A. (1997).** Eye-movements and visual imagery: a working memory approach to the treatment of post-traumatic stress disorder. *British Journal of Clinical Psychology*, 36, 209-223.

Tested the working memory theory. Eye movements were superior to control conditions in reducing image vividness and emotionality.

- **Barrowcliff, A.L., Gray, N.S., Freeman, T.C.A., MacCulloch, M.J. (2004).** Eye-movements reduce the vividness, emotional valence and electrodermal arousal associated with negative autobiographical memories. *Journal of Forensic Psychiatry and Psychology*, 15, 325-345.

Tested the reassurance reflex model. Eye movements were superior to control conditions in reducing image vividness and emotionality.

- **Barrowcliff, A.L., Gray, N.S., MacCulloch, S., Freeman, T. C.A., & MacCulloch, M.J. (2003).** Horizontal rhythmical eye-movements consistently diminish the arousal provoked by auditory stimuli. *British Journal of Clinical Psychology*, 42, 289-302.

Tested the reassurance reflex model. Eye movements were superior to control conditions in reducing arousal provoked by auditory stimuli.

- **Christman, S. D., Garvey, K. J., Propper, R. E., & Phaneuf, K. A. (2003).** Bilateral eye movements enhance the retrieval of episodic memories. *Neuropsychology*. 17, 221-229.

Tested cortical activation theories. Results provide indirect support for the orienting response/REM theories suggested by Stickgold (2002, 2008). Saccadic eye movements, but

not tracking eye movements were superior to control conditions in episodic retrieval.

- **Christman, S. D., Propper, R. E., & Brown, T. J. (2006).** Increased interhemispheric interaction is associated with earlier offset of childhood amnesia. *Neuropsychology*, 20, 336.

The results of the current Experiment 2 suggest that the eye movements employed in EMDR may induce a neurobiological change in interhemispheric interaction and an attendant psychological change in episodic retrieval.

- **Engelhard, I.M., van den Hout, M.A., Janssen, W.C., & van der Beek, J. (2010).** Eye movements reduce vividness and emotionality of “flashforwards.” *Behaviour Research and Therapy*, 48, 442–447.

This study examined whether eye movements reduce vividness and emotionality of visual distressing images about feared future events. . . Relative to the no-dual task condition, eye movements while thinking of future-oriented images resulted in decreased ratings of image vividness and emotional intensity.

- **Engelhard, I.M., van Uijen, S.L. & van den Hout, M.A. (2010).** The impact of taxing working memory on negative and positive memories. *European Journal of Psychotraumatology*, 1: 5623 – DOI: 10.3402/ejpt.v1i0.5623

Additional investigation of eye movements compared to Tetris from a working memory perspective.

- **Engelhard, I.M., et al. (2011).** Reducing vividness and emotional intensity of recurrent “flashforwards” by taxing working memory: An analogue study. *Journal of Anxiety Disorders* 25, 599–603.

Results showed that vividness of intrusive images was lower after recall with eye movement, relative to recall only, and there was a similar trend for emotionality.

- **Gunter, R.W. & Bodner, G.E. (2008).** How eye movements affect unpleasant memories: Support for a working-memory account. *Behaviour Research and Therapy* 46, 913–931.

Three studies were done that cumulatively support a working-memory account of the eye movement benefits in which the central executive is taxed when a person performs a distractor task while attempting to hold a memory in mind.

- **Kavanagh, D. J., Freese, S., Andrade, J., & May, J. (2001).** Effects of visuospatial tasks on desensitization to emotive memories. *British Journal of Clinical Psychology*, 40, 267-280.

Tested the working memory theory. Eye movements were superior to control conditions in reducing within-session image vividness and emotionality. There was no difference one-week

post.

- **Kearns, M., Engelhard I. M. (2015).** Psychophysiological responsivity to script-driven imagery: An exploratory study of the effects of eye movements on public speaking flashforwards. *Frontiers in Psychiatry*, 6, doi:10.3389/fpsy.2015.00115.

Relative to the control condition (imagery only), those who made eye movements whilst holding a mental image of this scenario in-mind demonstrated a significant decrease in heart rate, which acted as a measure of emotionality.

- **Kuiken, D., Bears, M., Miall, D., & Smith, L. (2002).** Eye movement desensitization reprocessing facilitates attentional orienting. *Imagination, Cognition and Personality*, 21, 3-20.

Tested the orienting response theory related to REM-type mechanisms. Indicated that the eye movement condition was correlated with increased attentional flexibility. Eye movements were superior to control conditions.

- **Kuiken, D., Chudleigh, M. & Racher, D. (2010).** Bilateral eye movements, attentional flexibility and metaphor comprehension: The substrate of REM dreaming? *Dreaming*, 20, 227–247.

This study adds additional support to the orienting response theory related to REM-type mechanisms. Evaluations of participants experiencing significant loss or trauma demonstrate differential effects in a comparison of eye movement and non-eye movement conditions.

- **Lee, C.W., & Drummond, P.D. (2008).** Effects of eye movement versus therapist instructions on the processing of distressing memories. *Journal of Anxiety Disorders*, 22, 801-808.

There was no significant effect of therapist's instruction on the outcome measures. There was a significant reduction in distress for eye movement at post-treatment and at follow-up. . . . The results were consistent with other evidence that the mechanism of change in EMDR is not the same as traditional exposure.

- **Maxfield, L., Melnyk, W.T. & Hayman, C.A. G. (2008).** A working memory explanation for the effects of eye movements in EMDR. *Journal of EMDR Practice and Research*, 2, 247-261.

In two experiments participants focused on negative memories while engaging in three dual-attention eye movement tasks of increasing complexity. Results support a working memory explanation for the effects of eye movement dual-attention tasks on autobiographical memory.

- **Nieuwenhuis, S., Elzinga, B. M., Ras, P. H., Berends, F., Duijs, P., Samara, Z., & Slagter, H. A. (2013).** Bilateral saccadic eye movements and tactile stimulation, but not auditory stimulation, enhance memory retrieval. *Brain and Cognition*, 81, 52-56.

Increased memory retrieval in two experiments support “the possibility that alternating bilateral activation of the left and right hemispheres exerts its effects on memory by increasing the functional connectivity between the two hemispheres.

- **Parker, A., Buckley, S. & Dagnall, N. (2009).** Reduced misinformation effects following saccadic bilateral eye movements. *Brain and Cognition*, 69, 89-97.

Bilateral saccadic eye movements were compared to vertical and no eye movements. “It was found that bilateral eye movements increased true memory for the event, increased recollection, and decreased the magnitude of the misinformation effect.” This study supports hypotheses regarding effects of interhemispheric activation and episodic memory.

- **Parker, A. & Dagnall, N. (2007).** Effects of bilateral eye movements on gist based false recognition in the DRM paradigm. *Brain and Cognition*, 63, 221-225.

Bilateral saccadic eye movements were compared to vertical and no eye movements. Those in the bilateral eye movement condition “were more likely to recognise previously presented words and less likely to falsely recognize critical non-studies associates.”

- **Parker, A., Relph, S. & Dagnall, N. (2008).** Effects of bilateral eye movement on retrieval of item, associative and contextual information. *Neuropsychology*, 22, 136-145.

The effects of saccadic bilateral eye movement were compared to vertical eye movements and no eye movements on the retrieval of item, associative and contextual information. Saccadic eye movements were superior on all parameters in all conditions.

- **Samara, Z., Bernet M., Elzinga, B.M., Heleen A., Slagter, H.A., & Nieuwenhuis, S. (2011).** Do horizontal saccadic eye movements increase interhemispheric coherence? Investigation of a hypothesized neural mechanism underlying EMDR. *Frontiers in Psychiatry*, 2, 4. doi: 10.3389/fpsy.2011.00004.

The study demonstrated that 30 seconds of bilateral saccadic EMs enhanced the episodic retrieval of non-traumatic emotional stimuli in healthy adults. There was no evidence for an increase in interhemispheric coherence. However, a number of caveats regarding interpretation are noted

- **Schubert, S.J., Lee, C.W. & Drummond, P.D. (2011).** The efficacy and psychophysiological correlates of dual-attention tasks in eye movement desensitization and reprocessing (EMDR). *Journal of Anxiety Disorders*, 25, 1-11.

EMDR-with eye movements led to greater reduction in distress than EMDR-without eye movements. Heart rate decreased significantly when eye movements began; skin conductance decreased during eye movement sets; heart rate variability and respiration rate increased significantly as eye movements continued; and orienting responses were more frequent in the

eye movement than no-eye movement condition at the start of exposure.

- **Sharpley, C. F. Montgomery, I. M., & Scalzo, L. A. (1996).** Comparative efficacy of EMDR and alternative procedures in reducing the vividness of mental images. *Scandinavian Journal of Behaviour Therapy*, 25, 37-42.

Eye movements were superior to control conditions in reducing image vividness.

- **Smeets, M. A., Dijks, M. W., Pervan, I., Engelhard, I. M., & Van den Hout, M. A. (2012).** Time-course of eye movement-related decrease in vividness and emotionality of unpleasant autobiographical memories. *Memory*, 20, 346-357.

Results revealed a significant drop [in eyes moving condition] compared to the [eyes stationary] group in emotionality after 74 seconds compared to a significant drop in vividness at only 2 seconds into the intervention. These results support that emotionality becomes reduced only after vividness has dropped.

- **van den Hout, M., Muris, P., Salemink, E., & Kindt, M. (2001).** Autobiographical memories become less vivid and emotional after eye movements. *British Journal of Clinical Psychology*, 40, 121-130.

Tested their theory that eye movements change the somatic perceptions accompanying retrieval, leading to decreased affect, and therefore decreasing vividness. Eye movements were superior to control conditions in reducing image vividness. Unlike control conditions, eye movements also decreased emotionality.

- **van den Hout, M., et al. (2011).** EMDR: Eye movements superior to beeps in taxing working memory and reducing vividness of recollections. *Behaviour Research and Therapy*, 49, 92-98.

Vividness of negative memories was reduced after both beeps and eye movements, but effects were larger for eye movements. Findings support a working memory account of EMDR and suggest that effects of beeps on negative memories are inferior to those of eye movements.

Additional Psychophysiological and Neurobiological Evaluations of EMDR Treatment

All psychophysiological studies have indicated significant de-arousal. Neurobiological studies have indicated significant effects, including changes in cortical, and limbic activation patterns, and increase in hippocampal volume.

- **Aubert-Khalifa, S., Roques, J. & Blin, O. (2008).** Evidence of a decrease in heart rate and skin conductance responses in PTSD patients after a single EMDR session. *Journal of EMDR Practice and Research*, 2, 51-56.

- **Bossini L., Fagiolini, A. & Castrogiovanni, P. (2007).** Neuroanatomical changes after EMDR in posttraumatic stress disorder. *Journal of Neuropsychiatry and Clinical Neuroscience*, 19, 457-458.
- **Bossini, L., Tavanti, M., Calossi, S., Polizzotto, N. R., Vatti, G., Marino, D., & Castrogiovanni, P. (2011).** EMDR treatment for posttraumatic stress disorder, with focus on hippocampal volumes: A pilot study. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 23, E1-2. doi:10.1176/appi.neuropsych.23.2.E1.
- **Frustaci, A., Lanza, G.A., Fernandez, I., di Giannantonio, M. & Pozzi, G. (2010).** Changes in psychological symptoms and heart rate variability during EMDR treatment: A case series of subthreshold PTSD. *Journal of EMDR Practice and Research*, 4, 3-11.
- **Grbesa et al.: (2010).** Electrophysiological changes during EMDR treatment in patients with combat-related PTSD. *Annals of General Psychiatry* 9 (Suppl 1):S209.
- **Harper, M. L., Rasolkhani-Kalhorn, T., & Drozd, J. F. (2009).** On the neural basis of EMDR therapy: Insights from qeeg studies. *Traumatology*, 15, 81-95.
- **Herkt, D., Tumani, V., Grön, G., Kammer, T., Hofmann, A., & Abler, B. (2014).** Facilitating access to emotions: Neural signature of EMDR stimulation. *PloS one*, 9(8), e106350.
- **Kowal, J. A. (2005).** QEEG analysis of treating PTSD and bulimia nervosa using EMDR. *Journal of Neurotherapy*, 9(Part 4), 114-115.
- **Lamprecht, F., Kohnke, C., Lempa, W., Sack, M., Matzke, M., & Munte, T. (2004).** Event-related potentials and EMDR treatment of post-traumatic stress disorder. *Neuroscience Research*, 49, 267-272.
- **Landin-Romero, R., et al. (2013).** EMDR therapy modulates the default mode network in a subsyndromal, traumatized bipolar patient. *Neuropsychobiology*, 67, 181-184.
- **Lansing, K., Amen, D.G., Hanks, C. & Rudy, L. (2005).** High resolution brain SPECT imaging and EMDR in police officers with PTSD. *Journal of Neuropsychiatry and Clinical Neurosciences*, 17,526-532.
- **Levin, P., Lazrove, S., & van der Kolk, B. A. (1999).** What psychological testing and neuroimaging tell us about the treatment of posttraumatic stress disorder (PTSD) by eye movement desensitization and reprocessing (EMDR). *Journal of Anxiety Disorders*, 13,159-172.
- **Nardo D et al. (2009).** Gray matter density in limbic and paralimbic cortices is associated with trauma load and EMDR outcome in PTSD patients. *Journal of Psychiatric Research*. doi:10.1016/j.jpsychires.2009.10.014

- **Oh, D.-H., & Choi, J. (2004).** Changes in the regional cerebral perfusion after Eye Movement Desensitization and Reprocessing: A SPECT study of two cases. *Journal of EMDR Practice and Research, 1*, 24-30.
- **Ohta ni, T., Matsuo, K., Kasai, K., Kato, T., & Kato, N. (2009).** Hemodynamic responses of eye movement desensitization and reprocessing in posttraumatic stress disorder. *Neuroscience Research, 65*, 375–383.
- **Pagani, M. et al. (2007).** Effects of EMDR psychotherapy on 99mTc-HMPAO distribution in occupation-related post-traumatic stress disorder. *Nuclear Medicine Communications, 28*, 757–765.
- **Pagani, M. et al. (2011).** Pretreatment, intratreatment, and posttreatment EEG imaging of EMDR: Methodology and preliminary results from a single case. *Journal of EMDR Practice and Research, 5*, 42-56.
- **Propper, R., Pierce, J.P., Geisler, M.W., Christman, S.D., & Bellorado, N. (2007).** Effect of bilateral eye movements on frontal interhemispheric gamma EEG coherence: Implications for EMDR therapy. *Journal of Nervous and Mental Disease, 195*, 785-788.
- **Richardson, R., Williams, S.R., Hepenstall, S., Sgregory, L., McKie, & Corrigan, F. (2009).** A single-case fMRI study EMDR treatment of a patient with posttraumatic stress disorder. *Journal of EMDR Practice and Research, 3*, 10-23.
- **Sack, M., Lempa, W., & Lemprecht, W. (2007).** Assessment of psychophysiological stress reactions during a traumatic reminder in patients treated with EMDR. *Journal of EMDR Practice and Research, 1*, 15-23.
- **Sack, M., Nickel, L., Lempa, W., & Lamprecht, F. (2003).** Psychophysiological regulation in patients suffering from PTSD: Changes after EMDR treatment. *Journal of Psychotraumatology and Psychological Medicine, 1*, 47 -57. (German)
- **van der Kolk, B., Burbridge, J., & Suzuki, J. (1997).** The psychobiology of traumatic memory: Clinical implications of neuroimaging studies. *Annals of the New York Academy of Sciences, 821*, 99-113.

Treatment of Military Personnel

As noted in the WHO (2013) guidelines and the American Psychiatric Association Practice Guidelines (2004, p.18), in EMDR therapy “traumatic material need not be verbalized; instead, patients are directed to think about their traumatic experiences without having to discuss them.” Given the reluctance of many combat veterans to divulge the details of their experience, this factor is relevant to willingness to initiate treatment, retention and therapeutic gains. It may

be one of the factors responsible for the lower remission and higher dropout rate noted in this population when CBT techniques are used.

As described previously, an RCT by Carlson et al. (1998) reported that after twelve EMDR treatment sessions, 77.7% of the combat veterans no longer met criteria for PTSD. There were no dropouts and effects were maintained at 3- and 9-month follow-up. In addition, the Silver et al., (1995) analysis of an inpatient veterans' PTSD program (n = 100) found EMDR to be superior to biofeedback and relaxation training on seven of eight measures. Russell et al. (2007) evaluated 72 active-duty military personnel, 48 diagnosed with combat PTSD and reported that pre-post changes were significant on all measures. A recent program evaluation of active duty military by McLay et al. (2016) compared various forms of treatment and reported, "*Results indicated that patients receiving EMDR had significantly fewer therapy sessions over 10 weeks but had significantly greater gains in their PCL-M scores than did individuals not receiving EMDR.*"

All other RCT of veterans have used insufficient treatment doses to assess PTSD outcomes (e.g., two sessions; see ISTSS, 2000; DVA/DoD, 2004). Sufficient treatment time must be used for multiply traumatized veterans (e.g., see below: Russell et al., 2007). However, in a process analysis, Rogers et al. (1999) compared one session of EMDR and exposure therapy with inpatient veterans, and a different recovery pattern was observed. The EMDR group demonstrated a more rapid decline in self-reported distress (e.g., SUD levels decreased with EMDR and increased with exposure).

As stated in the American Psychiatric Practice Guidelines (2004, p. 36), if viewed as an exposure therapy, "EMDR employs techniques that may give the patient more control over the exposure experience (since EMDR is less reliant on a verbal account) and provides techniques to regulate anxiety in the apprehensive circumstance of exposure treatment. Consequently, it may prove advantageous for patients who cannot tolerate prolonged exposure as well as for patients who have difficulty verbalizing their traumatic experiences. Comparisons of EMDR with other treatments in larger samples are needed to clarify such differences."

Such research is highly recommended. In addition, since EMDR utilizes no homework to achieve its effects it may be particularly suited for front line alleviation of symptoms (see Russell, 2006; Wesson & Gould, 2009). Further, the prevalent somatic and chronic pain problems experienced by combat veterans indicate the need for additional research based upon the reports of Russell (2008), Schneider et al., (2007, 2008) and Wilensky (2007), which demonstrate EMDR's capacity to successfully treat phantom limb pain (see also Ray & Zbik, 2001). The ability of EMDR to simultaneously address PTSD, depression, and pain can have distinct benefits for DVA/DoD treatment.

The following contain clinically relevant information for the treatment of veterans, including therapy parameters.

- **Carlson, J., Chemtob, C.M., Rusnak, K., Hedlund, N.L., & Muraoka, M.Y. (1998).** Eye movement desensitization and reprocessing (EMDR): Treatment for combat-related post-traumatic stress disorder. *Journal of Traumatic Stress, 11*, 3-24.
- **Cook, J.M., Biyanova, T., & Coyne, J.C. (2009).** Comparative case study of diffusion of eye movement desensitization and reprocessing in two clinical settings: Empirically supported

treatment status is not enough. *Professional Psychology: Research and Practice*, 40, 518–524.

Errebo, N. & Sommers-Flanagan, R. (2007). EMDR and emotionally focused couple therapy for war veteran couples. In F. Shapiro, F. Kaslow, & L. Maxfield (Eds.) *Handbook of EMDR and family therapy processes*. New York: Wiley

- **Lipke, H. (2000).** *EMDR and psychotherapy integration*. Boca Raton, FL: CRC Press.
- **McLay, R. N., Webb-Murphy, J. A., Fesperman, S. F., Delaney, E. M., Gerard, S. K., Roesch, S. C., Nebeker, B. J., Pandzic, I., Vishnyak, E. A., & Johnston, S. L. (2016, March 10).** Outcomes from eye movement desensitization and reprocessing in active-duty service members with posttraumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy*. Advance online publication. <http://dx.doi.org/10.1037/tra0000120>.
- **Russell, M. (2006).** Treating combat-related stress disorders: A multiple case study utilizing eye movement desensitization and reprocessing (EMDR) with battlefield casualties from the Iraqi war. *Military Psychology*, 18, 1-18.
- **Russell, M. (2008).** Treating traumatic amputation-related phantom limb pain: A case study utilizing eye movement desensitization and reprocessing (EMDR) within the armed services. *Clinical Case Studies*, 7, 136-153.
- **Russell, M.C. (2008).** War-related medically unexplained symptoms, prevalence, and treatment: Utilizing EMDR within the armed services. *Journal of EMDR Practice and Research*, 2, 212-226.
- **Russell, M.C. (2008).** Scientific resistance to research, training and utilization of eye movement desensitization and reprocessing (EMDR) therapy in treating post-war disorders *Social Science & Medicine*, 67, 1737–1746.
- **Russell, M.C. & Figley, C.R. (2013).** *Treating traumatic stress injuries in military personnel: An EMDR practitioner's guide*. New York: Routledge.
- **Russell, M.C., & Silver, S.M. (2007).** Training needs for the treatment of combat-related posttraumatic stress disorder. *Traumatology*, 13, 4-10.
- **Russell, M.C., Silver, S.M., Rogers, S., & Darnell, J. (2007).** Responding to an identified need: A joint Department of Defense-Department of Veterans Affairs training program in eye movement desensitization and reprocessing (EMDR) for clinicians providing trauma services. *International Journal of Stress Management*, 14, 61-71.
- **Silver, S.M. & Rogers, S. (2002).** *Light in the heart of darkness: EMDR and the treatment of war and terrorism survivors*. New York: Norton.

- **Silver, S.M., Rogers, S., & Russell, M.C. (2008).** Eye movement desensitization and reprocessing (EMDR) in the treatment of war veterans. *Journal of Clinical Psychology: In Session, 64*, 947—957.
- **Wesson, M. & Gould, M. (2009).** Intervening early with EMDR on military operations: A case study. *Journal of EMDR Practice and Research, 3*, 91-97.