



A meta-analysis of the contribution of eye movements in processing emotional memories

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ABSTRACT

Background and objectives: Eye Movement Desensitisation and Reprocessing (EMDR) is now considered evidence based practice in the treatment of trauma symptoms. Yet in a previous meta-analysis, no significant effect was found for the eye movement component. However methodological issues with this study may have resulted in a type II error. The aim of this meta-analysis was to examine current published studies to test whether eye movements significantly affect the processing of distressing memories. **Method:** A systematic review of the literature revealed two groups of studies. The first group comprised 15 clinical trials and compared the effects of EMDR therapy with eye movements to those of EMDR without the eye movements. The second group comprised 11 laboratory trials that investigated the effects of eye movements while thinking of a distressing memory versus the same procedure without the eye movements in a non-therapy context. The total number of participants was 849. **Results:** 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 ($d = 0.74$). The strongest effect size difference was for vividness measures in the non-therapy studies ($d = 0.91$). The data indicated that treatment fidelity acted as a moderator variable on the effect of eye movements in the therapy studies. **Conclusions:** Results were discussed in terms of current theories that suggest the processes involved in EMDR are different from other exposure based therapies.

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A number of previous meta-analyses have found that EMDR has sustained and lasting treatment effects for Posttraumatic Stress Disorder (Bisson et al., 2007; Bradley, Greene, Russ, Dutra, & Westen, 2005; Seidler & Wagner, 2006). EMDR is now considered to meet criteria for evidence-based practice in the United Kingdom by the National Institute for Clinical Excellence (2005), in America by the American Psychiatric Association (2004), in Australia by the Australian Centre for Posttraumatic Mental Health (2007), and in the Netherlands by the Dutch National Steering Committee for Guidelines for Mental Health Care (2003).

Although the active processes in EMDR appear to be different to traditional exposure treatments (Lee, Taylor, & Drummond, 2006), the mechanism of action for the success of EMDR remains controversial (Rogers & Silver, 2002; Shapiro, 2012; Smyth & Poole, 2002). There is disagreement as to whether eye movements add

anything to the effectiveness of EMDR (Davidson & Parker, 2001; MacCulloch, 2006).

The treatment studies that have attempted to isolate the eye movement component from the full treatment package have produced results ranging from a very large effect size consistent with eye movements enhancing processing (Wilson, Silver, Covi, & Foster, 1996) to findings of no differences (Renfrey & Spates, 1994). On the other hand, non-clinical laboratory studies that investigated the effects of eye movements on autobiographical memories have found decreases in vividness and/or emotionality compared to control conditions such as finger tapping (van den Hout, Muris, Salemink, & Kindt, 2001), spatial tapping (Andrade, Kavanagh, & Baddeley, 1997), and no eye movement (Barrowcliff, Gray, Freeman, & MacCulloch, 2004; Gunter & Bodner, 2008; Kavanagh, Freese, Andrade, & May, 2001). Whilst these laboratory studies show a clear processing effect for eye movements, they did not involve all the procedural elements of EMDR (Shapiro, 2001: p. 472).

In an attempt to discover any general trends in research that has examined the effects of eye movements on memory, Davidson and

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Parker (2001) conducted a meta-analysis of published studies investigating effect size differences between EMDR with eye movements and EMDR without eye movements. Their conclusion when looking at pre-versus-post single session measures was that there was no significant additional effect of eye movements. Their measure of effect size was R , which ranges from plus one to minus one; R^2 is the amount of variance in the dependent variable accounted for by the independent variable. However there were methodological problems in this meta-analysis. Initially R scores were converted to Z scores. The simple mean of these scores was converted back to R , and then subjected to a t -test using the number of studies to determine the degrees of freedom. The problem with this approach is that it treats all studies as if they are of equal weight. The usual practice in meta-analysis is to weight each study in relation to the number of participants and for the degrees of freedom to be calculated using the total number of participants (Rosenthal & DiMatteo, 2001). This provides a more appropriate test of significance and provides more power to investigate small magnitude effect sizes (Rosenthal, 1991).

Since 2001, there have been additional published papers investigating the effects of eye movements on various measures. Therefore, we decided to conduct a new meta-analysis, including all studies published in the past 23 years and adjusting for the sample size in each study.

1. Method

1.1. Search procedure

Searches were conducted in Medline, PsycINFO, and Science Direct databases. The search was done in two parts: the first used the keywords *non eye movement* or *no eye movement* or *eyes fixed* or *eyes stationary* or *without the eye movement* or *eye stationary* paired with *eye movements*, or *eyes moving* or *eye movement*; the second also used a keyword search of *eye movements* paired with *eye movement desensitization*. The search was restricted to articles only involving humans and between 1989 (when EMDR was first published) and 2012. An *a priori* decision was made to search only published work and to control for publication bias by a *posteriori* analysis. Additional studies were identified by manual searches of past meta-analyses (Davidson & Parker, 2001; Rodenburg, Benjamin, de Roos, Meijer, & Stams, 2009) and recent reviews of the role of eye movements in EMDR (Gunter & Bodner, 2009; Smeets, Dijs, Pervan, Engelhard, & van den Hout, 2012).

1.2. Inclusion/exclusion criteria

We included randomized controlled trials in which a negative memory task with eye movements was compared to the same task but without the eye movements, under otherwise identical conditions. Thus if a study compared eye movement plus tapping to no eye movement plus tapping then such a study could be said to compare the presence or absence of eye movement in identical conditions. However a study that compared eye movement without tapping to no eye movement with tapping is not comparing the main variable of interest in identical conditions. Therefore we included only studies comparing eye movements versus no eye movement, studies in which eye movements were compared with an alternative stimulus were excluded.

We included two types of studies. In the first type, (laboratory studies) the participants simply were asked to think of a distressing memory and then they were randomized to a procedure with eye movements or to the same procedure but without eye movements. This was done in all these studies over a very short period of time and in one session (average total eye movement exposure 52 s).

The second group of studies (treatment studies) examined the effects of EMDR on participants with an anxiety disorder or a distressing memory, and compared EMDR with eye movements with exactly the same procedure but without the eye movements. These clinical interventions used between 5 and 8 phases of the EMDR treatment protocol (Shapiro, 2001: p. 472) and these studies had more extensive exposure to eye movements than the first group of studies. We decided to conduct an independent meta-analysis for each of these two groups of studies.

1.3. Quality assessment

We assessed the validity of the treatment and laboratory studies using four criteria of the 'Risk of bias' assessment tool, developed by the Cochrane Collaboration (Higgins & Green, 2008). This tool assesses possible sources of bias in randomized trials, including the adequate generation of allocation sequence; the concealment of allocation to conditions; the prevention of knowledge of the allocated intervention; and dealing with incomplete outcome data. The two other criteria of the 'Risk of bias' assessment tool (suggestions of selective outcome reporting; and other problems that could put it at a high risk of bias) were not used in this study, because we found no clear indication that they had influenced the validity of any of the studies reviewed.

We also rated the quality of the treatment implementation using three criteria which were based on an authoritative review of empirically supported psychotherapies (Chambless & Hollon, 1998): (1) the study referred to the use of a treatment manual (either a published manual, or a manual specifically designed for the study); (2) the therapists who conducted the therapy were trained for the specific therapy, either specifically for this study or as general training; (3) treatment integrity was checked during the study (by supervision of the therapists during treatment or by recording of treatment sessions, or by systematic screening of protocol adherence with a standardized measurement instrument). The ratings were made by two PhD students and each study was discussed until a consensus was reached.

1.4. Analyses

For each study, we calculated Cohen's d (standardized mean difference) by subtracting (at post-test) the average score of the control group (M_c) from the average score of the experimental group (M_e) and dividing the result by the pooled standard deviations of the experimental and control group (SD_{ec}). Effect sizes of 0.80 and higher are regarded as large, while effect sizes of 0.50–0.80 are moderate, and lower effect sizes are small (Cohen, 1988). Because several studies had small sample sizes we corrected the effect size for small sample bias according to the procedures suggested by Hedges and Olkin (1985). Each author separately calculated effect size data from each study and discrepancies were discussed until consensus was reached. When means and standard deviations were not available in the study, we used other statistics (t -value, p -value) to calculate the effect size using Comprehensive Meta-analysis software (version 2.2057; CMA). When a study reported only a non-significant difference between conditions at post-test without reporting more specific statistics, we conducted the authors and asked for more specific data otherwise we assumed a zero effect size. The calculated effect sizes were based on self report and observer rated symptoms only. An early attempt was made to include physiological measures. However, these varied largely between the studies in the type of physiological measures used and the way that they were reported. This prevented any meaningful analysis across the studies and so this data was excluded.

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