Feedback interventions for impaired self-awareness following brain injury: A systematic review

Author

Schmidt, Julia, Lannin, Natasha, Fleming, Jennifer, Ownsworth, Tamara

Published

2011

Journal Title

Journal of Rehabilitation Medicine

DOI

10.2340/16501977-0846

J Rehabil Med 2011; 43: 673–680

REVIEW ARTICLE

FEEDBACK INTERVENTIONS FOR IMPAIRED SELF-AWARENESS FOLLOWING BRAIN INJURY: A SYSTEMATIC REVIEW

Julia Schmidt, BSc[1,2], Natasha Lannin, PhD[1,3,4], Jennifer Fleming, PhD[2,5,6] and Tamara Ownsworth, PhD[7]

From the [1]Royal Rehabilitation Centre, Sydney, Sydney, [2]The University of Queensland, School of Health and Rehabilitation Sciences, Brisbane, [3]Rehabilitation Studies Unit, The University of Sydney, Sydney, [4]The Institute for Safety, Compensation and Recovery Research, Melbourne, [5]Princess Alexandra Hospital, and [6]Centre for Functioning and Health Research, Metro South Health District, and School of Psychology, Griffith University, Brisbane, Australia

Objective: **To determine the effectiveness of self-awareness interventions that involve a component of feedback for adults with brain injury.**
Design: **Systematic review.**
Data sources: **Randomized and non-randomized studies identified by searching CINAHL, Cochrane Systematic Review Database, Embase, Medline, OTSeeker, PsycBITE, PsycINFO, Web of Science, clinical trial registries, and reference lists of eligible articles.**
Results: **Twelve studies of varied methodological quality met the inclusion criteria, of which 3 were randomized controlled trials involving a total of 62 people with brain injury of mixed aetiology. The type of feedback intervention and outcomes assessed were heterogeneous. The pooled estimate of improvement in self-awareness after completing a feedback intervention was of moderate effect size (Hedges' adjusted g = 0.64; 95% confidence interval: 0.11–1.16).**
Conclusion: **Feedback interventions produced modest improvements in self-awareness. Further research is required to determine the effects of integrating feedback interventions into rehabilitation programmes and the impact of this on functional outcome.**

Key words: self-knowledge; insight; awareness; feedback.

J Rehabil Med 2011; 43: 673–680

Correspondence address: Julia Schmidt, Brain Injury Unit, Royal Rehabilitation Centre, Sydney, PO Box 6, Ryde NSW, 1680, Australia. E-mail: Julia.Schmidt@royalrehab.com.au

Submitted February 23, 2011; accepted May 30, 2011

INTRODUCTION

People with acquired brain injury often have impaired self-awareness (1, 3, 7, 8). Self-awareness deficits in brain injury have been reported as occurring in up to 97% of patients with traumatic brain injury (TBI) (1) and being dependent on injury severity (2). Self-awareness is described as a person's ability to perceive his or herself objectively while maintaining a sense of subjectivity (3–5). It is defined clinically as an understanding of one's abilities and limitations and how this impacts on task performance in everyday living (6). Decreased self-awareness is suggested to occur due to a number of neuroanatomical as well as cognitive impairments (7, 8).

The theoretical model proposed by Crosson et al. (9) discusses self-awareness as a 2-tiered construct. The first level is intellectual awareness, defined as the ability to understand that physical and cognitive function is impaired (for example, awareness of a memory deficit) (1). The second level is referred to as on-line awareness, which is the ability to recognize one's impairments within a task (9, 10). Within the framework of on-line awareness, it is suggested that there are two further types of awareness: on-line emergent awareness (the ability to describe difficulties as they occur) and on-line anticipatory awareness (the ability to predict difficulties due to one's impairments) (10).

There is debate within the structures of various models of awareness in previous research (11). Some research has reported that the types of awareness are hierarchical (one must first obtain intellectual awareness in order to experience on-line awareness) (9), while others bodies of research report an interactional model between the types of awareness (10). Research has demonstrated little correlation between intellectual awareness and on-line emergent awareness ($r = 0.184$) and between intellectual awareness and on-line anticipatory awareness ($r = 0.009$), but strong correlation between on-line emergent and on-line anticipatory awareness ($r = 0.717$), suggesting that at least 2 separate constructs exist; intellectual awareness and on-line awareness (11).

Regardless of the theoretical framework, it is well recognized that impaired self-awareness impacts negatively on the outcomes of rehabilitation and limits successful functioning in everyday life (12–14). People with impaired self-awareness following brain injury have decreased understanding of the functional impact of brain injury-related impairments (1, 15), which can contribute to unrealistic goals for the future (15). Consequently, these individuals may present as difficult to engage in therapy (1), with reduced motivation and poor acceptance of the use of compensatory strategies (16–18). In the longer term, this may lead to difficulty achieving and maintaining productive and independent living (1, 19). Alternatively, people with a brain injury who are aware of, and understand their limitations, are able to set more realistic goals and typically experience greater community reintegration (16, 20). Developing self-awareness in people with a brain injury is therefore an important outcome for rehabilitation (17).

There are various rehabilitation interventions designed to facilitate the development of self-awareness in people with

brain injury. These include neuropsychological programmes, psychotherapy, compensatory and facilitatory approaches, structured experiences, direct feedback, videotaped feedback, confrontational techniques, cognitive therapy, group therapy, game formats and behavioural intervention (21). Awareness interventions commonly incorporate an element of feedback on the person's abilities (21). Feedback can be provided verbally to a person with a brain injury, by a therapist describing the positive and negative aspects of the person's task performance (22, 23); visually, by watching video-recordings of the person's own task performance (24–26); and in an individual therapy or group context, incorporating the use of peer feedback (3, 23). Many authors have emphasized timely, specific and consistent feedback as being an important component of all awareness interventions (3, 23, 27–30).

The use of feedback for enhancing performance is also a fundamental component of the rehabilitation process (6). The provision of feedback on assessment results, progress in therapy, and attainment of goals is considered an important component of education for a person with a brain injury that enhances rehabilitation outcomes (17). Despite its widespread use, there are currently no clinical guidelines for providing feedback in brain injury rehabilitation (21). This systematic review evaluates all studies, including randomized and non-randomized trials, that employ feedback interventions for improving self-awareness in people after a brain injury.

Objective

The aim of this systematic review was to determine the effectiveness of self-awareness interventions, which involve a feedback component on clinical outcomes, in adults with brain injury. Specifically, the review sought to determine whether:

- interventions with a component of feedback effectively increase self-awareness and other clinically relevant outcomes, namely, functional task completion and satisfaction with performance;
- there is a pattern in the intervention or type of approach (e.g. group vs individual; verbal vs video feedback) that is most effective

METHODS

Eligibility criteria

Studies that investigated the effects of a self-awareness intervention involving a feedback component were included in the review. Studies reported in languages other than English were not included, as translations were not available. Further eligibility criteria for inclusion in the review were as follows:

- Types of studies: studies were designed to have at least a level of evidence of IV (case-series, poor quality cohort and case-controlled studies), but not including level Ia (systematic reviews). Studies included in the meta-analysis were restricted to randomized (level Ib) or quasi-randomized (level II) studies in which random allocation to group has not been followed precisely (31) (Table I).
- Population: participants were over 16 years of age. In accordance with recommendations of the Cochrane Collaboration Injuries Group, (32) at least 50% of the participants in each study had brain injury.
- Intervention: interventions involved a feedback component, which was defined *a priori* to include: (*i*) group sessions incorporating feedback; (*ii*) direct verbal feedback from therapists; (*iii*) audio-visual feedback (the person with the brain injury observes their own performance from an audiovisual recording such as a video); (*iv*) experiential feedback (the person with the brain injury completes a task with a pre-defined specific criteria to attain); (*v*) feedback on cognitive test performance; (*vi*) feedback on overall functional task completion, such as activities of daily living; (*vii*) sensory input (including visual or auditory feedback) when the person with a brain injury is performing a task; (*viii*) identification of errors that a person with a brain injury makes by the therapist or person (including self-evaluation training); and (*ix*) identification of strengths and limitations by the therapist or person with a brain injury. The definition of feedback did not include biofeedback or feedback about a physical impairment, as the focus of this systematic review was feedback as a meta-cognitive strategy to promote improved task performance, rather than feedback designed to adjust performance at the level of physical impairment. The definition did not include psychological and counselling interventions without specific feedback or education/psycho-education without individual feedback, since the purpose of this review centred on the efficacy of feedback interventions.
- Outcome: studies included a measure of self-awareness at baseline and post-intervention. Measures of self-awareness included both standardized measures for intellectual awareness and observational assessments to determine on-line awareness (improvement of task performance using pre-defined specific criteria). Measures were permitted to be discrepancy ratings, comparison of patients' self-ratings with objective test performance, and/or standard neuropsychological tests. The primary clinical outcome was an increase in self-awareness; the secondary outcomes, when available, included improvement in functional task completion (activities of daily living) and satisfaction with performance.

Table I. *Levels of evidence*

Quality of the study	Definition of quality level
Level 1a	Systematic reviews (with heterogeneity) of randomized controlled trials
Level 1b	Individual randomized controlled trials
Level 2a	Systematic review (with heterogeneity) of cohort studies
Level 2b	Individual cohort study or low quality randomized controlled trials
Level 2c	Outcomes research, ecological studies
Level 3a	Systematic review (with homogeneity) of case-control studies
Level 3b	Individual case-control study
Level 4	Case-series and poor quality cohort and case control studies
Level 5	Expert opinion without explicit critical appraisal

Based on Wiley-Blackwell Levels of Evidence (31).

Search strategy

Electronic databases were searched for the period 1980 to 3 August 2010: Cochrane Systematic Review Database (including Cochrane database of systematic reviews, Cochrane central register of controlled trials and the Database of Abstracts of Reviews of Effects (DARE)), Medline, CINAHL, PsycINFO, Embase, Web of Science, PsycBITE, and OTSeeker. In addition, the clinical trial registers at controlled-trials.com, clinicaltrials.gov and actr.org.au were also searched for unpublished trials. Bibliographies of included studies were then searched recursively until no more studies were identified.

The following keywords were mapped to MeSH/subject headings: (*i*) feedback, therapy, intervention, psycho-education, rehabilitation, treatment; (*ii*) self-awareness, awareness insight, unawareness; (*iii*) stroke, brain injury, brain injuries, brain damage, traumatic brain injuries, brain trauma, traumatic, brain encephalopathy, cerebral vascular accident, CVA. The full search strategy for each database is available from the first author on request.

Process of review

As per the PRISMA guidelines for systematic reviews (33), 2 reviewers (JS and NL) independently screened search results for potentially eligible studies. Lack of consensus about the eligibility of a particular study was resolved by discussion with a third reviewer (JF), which was warranted for 3 articles. No reviewers screened the studies for inclusion into the review, rated the studies for quality, or extracted data from studies in which they were authors.

Rating of study quality

Methodological quality was independently assessed by 2 reviewers. Quality of randomized and pseudo-randomized trials was rated using the PEDro scale (34). This scale rates controlled trials based on random and concealed allocation of participants, the similarities of participants at baseline, blinding of subject, therapists, and assessors, the dropout rate, the use of intention to treat analysis and reporting point measures, measures of variability and between-group statistical comparisons. A total score out of 10 was derived for each study from the number of criteria satisfied. Single-subject designed trials, also known as single-participant designs, were rated using the Single Case Experimental Design (SCED) scale (35). The SCED scale rates single-case trials based on the description of the target behaviour, precise and repeatable measures, design with a control condition, multiple baseline and treatment measures reported as raw data, inter-rater reliability of measurements, statistical reporting of effect sizes, blinding of the assessor, and the ability for the treatment to be replicated and generalized (35). A total score out of 11 was derived for each study according the number of criteria satisfied.

Data extraction

Two reviewers independently rated all studies for quality and extracted data investigating the effects of feedback components on self-awareness. The inter-rater reliability of quality ratings was acceptable (agreement = 91.5%). In instances where data were not presented in the published paper, raw data were requested from authors; results from one published study (22) were obtained in this manner.

Data synthesis

Where more than one study was available on a particular outcome, the homogeneity of participants, interventions, and outcomes were assessed. Clinical homogeneity was assessed by the authors and statistical heterogeneity was calculated using I^2, where an I^2 of greater than 30% in the presence of significant χ^2 test result (p-value < 0.10) was interpreted as indicating heterogeneity (32). Results of consistent studies were pooled in a meta-analysis, using standardized mean difference and fixed effect model to control for differences in measurement tools (32).

Where a single study reported results from more than one measure within a particular outcome area, it was assumed that the first-reported outcome was the primary outcome, and only the primary outcome was included in the meta-analysis. Meta-analysis of continuous outcomes was performed with a fixed-effects model using Review Manager 5, producing a standardized difference in means for each outcome (Hedges' adjusted g), which is the difference between the means divided by the pooled standard deviation (36). Standardized differences were interpreted according to guidelines suggested by Cohen (37): 0.2 represents a small effect, 0.5 a moderate effect, and 0.8 a large effect.

RESULTS

Overall, 1,070 potential papers were identified and 1,058 of these were excluded. Twelve studies met the criteria for inclusion (6, 22, 26, 38–45, 47) (Table II). Of the 12 included studies, 2 were randomized controlled trials, 1 was a quasi-randomized controlled trial and 9 employed AB designs (pre–post comparisons) (46). Fig. 1 summarizes the search results and the number of articles excluded in each stage of the review.

Within the included studies, 14 different feedback techniques or intervention strategies were used. These included: (*i*) identification of errors during task performance by the therapist and/or person with a brain injury; (*ii*) discussion between the therapist and a person with a brain injury on the discrepancy of the rating of task performance; (*iii*) identification of strengths and limitations by the therapist and/or person with a brain injury (prior to task completion and following task completion); (*iv*) experiential feedback (repetitive completion of task); (*v*) direct and concrete verbal feedback from therapists; (*vi*) audiovisual feedback (observing own performance from an audiovisual recording such as a video); and (*vii*) post-task feedback on functional task performance (including strategy identification and provision).

The methodological quality of the trials was moderate, with scores for randomized controlled trials ($n = 3$) ranging from 4 to 7 (mean 5.67) out of 10 on the PEDro scale. In the study by Ownsworth et al. (22), 3 groups were compared, each having a wait-list control condition. The groups included individualized education, facilitator feedback and goal-setting; group-based education, peer feedback, and goal-setting; and a combined condensed individual and group-based intervention. In the study by Goverover et al. (39), goal-setting, predicting errors, anticipating errors, strategy planning, self-estimation of performance and task reflection was compared with conventional practice with direct corrective feedback. The third trial included in by Cheng & Man (38), education and functional training sessions (including goal-setting, verbal feedback and self-prediction of performance) was compared with conventional therapy. Methodological quality of the single-case studies ($n = 9$) was moderate, with scores ranging from 5 to 10 (mean 7.22) out of 11 on the SCED scale. Each study is summarized in Table I.

Efficacy analyses

A meta-analysis was completed using the randomized controlled trials and quasi-randomized controlled trials. Although each trial

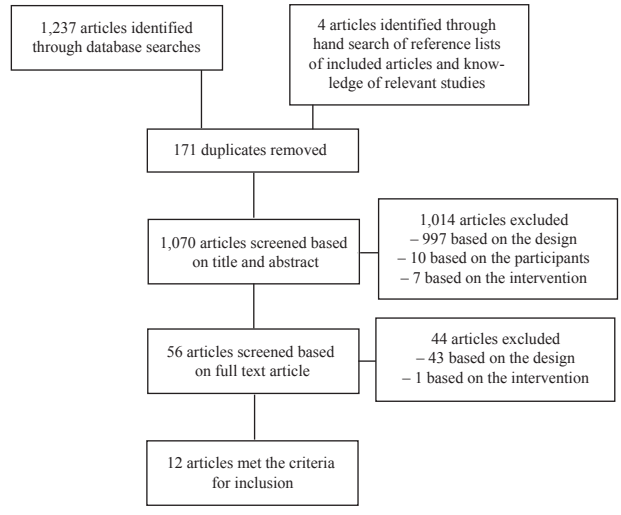

Fig. 1. Screening of studies for eligibility.

Table II. *Summary of studies in systematic review*

Name of study	Study design	Quality rating[a]	Population	Setting	Interventions	Measure of self-awareness	Intervention effect on self-awareness
Ownsworth et al., 2008 (22)	Randomized controlled trial	PEDro: 7/10	*n* = 35 Mean age: 44 years Diagnosis: Mixed brain injury	Outpatient, Australia	Individualized intervention included education, facilitator feedback and goal-setting. Group-based intervention included group-based education, peer feedback, and goal-setting. Condensed individual and condensed group-based intervention.	Patient Competency Rating Scale self-rated and carer-rated	Increase in awareness of deficits in the 2 groups that had intervention provided in a comprehensive individual and group setting, compared with the group that did not have any intervention.
Goverover et al., 2007 (39)	Randomized controlled trial	PEDro: 6/10	*n* = 20 Mean age: 39 years Diagnosis: Mixed brain injury	Outpatient, USA	Prior to the task, participants defined goals, predicted performance, anticipated errors, chose strategy to overcome difficulties, and assessed amount of assistance. After the task, participants self-estimated performance, discussed with therapists, and reflected by writing in a journal.	Assessment of Awareness of Disability; Self-Regulation Skills Interview; Awareness Questionnaire	No statistically significant change in task-specific awareness between the experimental and the control group after the intervention, but scores generally improved for the experimental group and worsened for the control group. There was significant improvement in self-regulation for the experimental group compared with the control group.
Cheng & Man, 2006 (38)	Quasi-randomized controlled trial	PEDro: 4/10	*n* = 21, Mean age: 55, Diagnosis: TBI	Inpatient, Hong Kong	Educational sessions and experiential functional training sessions including concrete verbal feedback, self-prediction of performance and goal-setting exercises through daily tasks.	Self-Awareness of Deficits Interview	Within-group analysis showed improvement in awareness in experimental group, between-group analysis showed statistically significant scores for experimental group.
Ownsworth et al., 2006 (41)	Pre–post design with multiple baselines collected across settings	SCED: 10/11	*n* = 1 Mean age: 36 years Diagnosis: TBI	Outpatient, Australia	Role reversal and observation of task, including observing video of performance of task and discussing strategies to check process.	Error frequency; Error behaviour (% self-corrected); Awareness Questionnaire; Self-Awareness of Deficits Interview	Decrease in error frequency (average of 44% reduction); increase in self-correction of errors and correction with non-specific prompts; decrease in discrepancy ratings of self-awareness between participant and therapist (not a clinically meaningful change), therefore demonstrating increase in intellectual awareness; no significant improvement in online awareness.
Ownsworth et al., 2010 (26)	Pre–post design	SCED: 9/11	*n* = 2 Mean age: 40 years Diagnosis: TBI	Outpatient, Australia	During performance of a functional task, the therapist waited ("paused") if the participant started to make an error to allow self-correction of the error and provided non-specific direction ("prompt") if the error continued. The therapist affirmed the participant for correct performance. Discussions occurred to encourage independence in task completion; role reversal and video analysis of performance also occurred.	Error frequency (self-corrections); error behaviour (therapist corrected errors and checks); Participant Competency Rating Scale	Increase in participants' self-corrected errors, decrease in therapist corrected errors, decrease in number of times the participant checked to ensure accuracy of task performance, and decrease in self-awareness of functional competence after intervention.
Ownsworth et al., 2010 (26)	Pre–post design	SCED: 9/11	*n* = 1 Mean age: 26 years Diagnosis: TBI	Outpatient, Australia	The therapist affirmed the participant for correct performance on the steps, waited ("paused") for the participant to self-correct the error, and then provided a specific prompt if the participant had not corrected of the error.	Error frequency (self-corrections); error behaviour (therapist corrected errors and checks); Patient Competency Rating Scale	No significant increase in self-corrected errors, no significant change in therapist corrected errors, significant increase in checks after treatment sessions, improvement in perception of functional competence after intervention.

Gajar et al., 1984 (44)	Pre–post design	SCED: 8/11	*n*=2 Mean age: 22 years Diagnosis: TBI	Unclear, likely outpatient; USA	Feedback was given in real-time during group conversations by visually displaying when participants were demonstrating good or poor conversation skills. Participants self-monitored their conversations by using a visual display. Participants reflected on their performance and analysed their behaviour during the conversations.	Number of errors made (inappropriate conversations)	Improvement in appropriateness during conversations.
Fleming et al., 2006 (40)	Pre–post design	SCED: 7/11	*n*=4 Mean age: 33 years Diagnosis: Mixed brain injury.	Outpatient, Australia	Meaningful occupations were selected and performed. Multiple feedback techniques were used including self-prediction and self-evaluation of performance, timely and non-confrontational verbal feedback and videotaped feedback.	Self-Awareness of Deficits Interview; Patient Competency Rating Scale	Improvement of self-awareness and task performance.
Toglia et al., 2010 (45)	Pre–post design	SCED: 7/11	*n*: 4 Mean age: 38 years Diagnosis: TBI	Outpatient, USA	Initially, participants were not provided with prompts or assistance. Strategy training and mediation was provided by interrupting participants during task performance with brief periods of intense mediation as needed. The therapist encouraged and reinforced the strategies were used by the participants.	Awareness Questionnaire	Increased strategy use and awareness.
Rebmann & Hannon, 1995 (43)	Pre–post design	SCED: 7/11	*n*=3 Mean age: 22 years Diagnosis: Mixed brain injury	Outpatient, USA	Participants were shown what they predicted and how it differed from actual performance on test results. Positive reinforcement was provided if participants had less discrepancy between predicted and actual performance. Feedback given using a problem solving approach.	Predicted vs actual performance on Memory Test Scores	Decrease in difference between predicted and actual scores following treatment.
Schlund, 1999 (6)	Pre–post design	SCED: 7/11	*n*=3, Mean age: 36 years, Diagnosis: TBI	Outpatient, USA	Each participant identified an inappropriate behaviour. Participants were informed about the frequency of inappropriate behaviour on a weekly basis in psychology sessions. This review allowed subjects to observe changes in the frequency of their behaviour over time.	Number of errors made in behaviour	The variability and frequency of inappropriate behaviour generally decreased.
Coetzer & Corney 2001 (42),	Pre–post design	SCED: 5/11	*n*: 22 Mean age: 41 years Diagnosis: Mixed brain injury	Outpatient, UK	Results of awareness tests explained to participants, emphasising the awareness difficulties. An opportunity for discussion and questions was provided.	European Brain Injury Questionnaire; Impaired Self-Awareness subscale; Awareness Questionnaire	Statistically significant increase in awareness on 1 outcome measure and no statistically significant change on another outcome measure.
Landa-Gonzalez, 2001 (47)	Pre–post design	SCED: 5/11	*n*=1 Mean age: 34 years Diagnosis: TBI	Inpatient, Florida USA	In conjunction with daily multi-context occupational activities, participants predicted the accuracy of task performance, used self-rating scales, and were encouraged to self-monitor performance. Therapists used role reversal and checklists.	Difference between predicted performance and actual performance of activity of daily living task	Improved acknowledgement of impairments and ability to recognize a problem as it was occurring. Improved ability to accurately predict task performance.

[a]The PEDro scale rates controlled trials (34) and the SCED scale rates single-case trials (35).
SCED: Single Case Experimental Design scale; TBI: traumatic brain injury.

used different outcome tools, the primary outcome areas were the same (improvement in self-awareness, functional task completion or satisfaction with performance) and the interventions were sufficiently homogeneous. Pooling of data was therefore considered appropriate using a standardized mean difference as an effect measure and a fixed effect within the analysis model, as this controls for differences in measurement tools (32).

Effect of feedback on self-awareness

Three studies (22, 38, 39) provided data on the efficacy of feedback training for improving self-awareness. The trials were sufficiently homogeneous with respect to participants' characteristics, as participants were adults with brain injuries. The interventions were sufficiently homogeneous, as all interventions included an element of goal-setting, education, and verbal feedback from a therapist. The studies differed in setting from inpatient (38) to community-based (22, 39) and differed in the number of treatment sessions (6 (39), 8 (22) and 40 (38)). Data from 62 participants were pooled (31 participants allocated to feedback groups, 31 participants allocated to control groups only). Fig. 2a shows the findings of the 3 studies and pooled estimates. The results from Cheng & Man (38) had the largest effect, with a standardized mean difference of 1.27 and a 95% confidence interval (CI) of 0.32–2.23. Overall, the 3 feedback interventions had a moderate effect on self-awareness (standardized mean difference = 0.64 favouring feedback intervention; 95% CI 0.11–1.16, $p = 0.02$).

Effect of feedback on functional task completion

The same 3 studies (22, 38, 39) provided data on the efficacy of feedback training for improving functional task completion ($n = 62$ participants pooled). The results from Ownsworth et al. (22) had the largest effect, with a standardized mean difference of 1.59 and a 95% CI of 0.58–2.60. In total, based on the included studies, feedback interventions had a large effect on functional task completion (standardized mean difference = 0.90 favouring feedback intervention; 95% CI 0.36–1.43, $p = 0.01$) (Fig. 2b).

Effect of feedback on satisfaction with performance

Two studies (22, 39) provided data on the efficacy of feedback training in terms of participant satisfaction with their functional task completion. The trials were moderately homogeneous with respect to interventions, participants and number of intervention sessions. Data from 41 participants were pooled (20 participants allocated to feedback groups, 21 participants allocated to control groups only). The results from Ownsworth et al. (22) had the largest effect, with a standardized mean difference of 1.29 and a 95% CI of 0.33–2.25. Based on included studies, feedback interventions had a large effect on participant satisfaction with performance (standardized mean difference = 0.83 favouring feedback intervention; 95% CI 0.18–1.48, $p = 0.01$).

DISCUSSION

Overall, this systematic review aimed to determine the effectiveness of self-awareness interventions that involve a feedback component on clinical outcomes in adults with brain injury. Of the 12 studies that were included in the review, 3 met the criteria for meta-analysis. All 3 clinical outcomes of self-awareness, functional task completion and satisfaction with performance

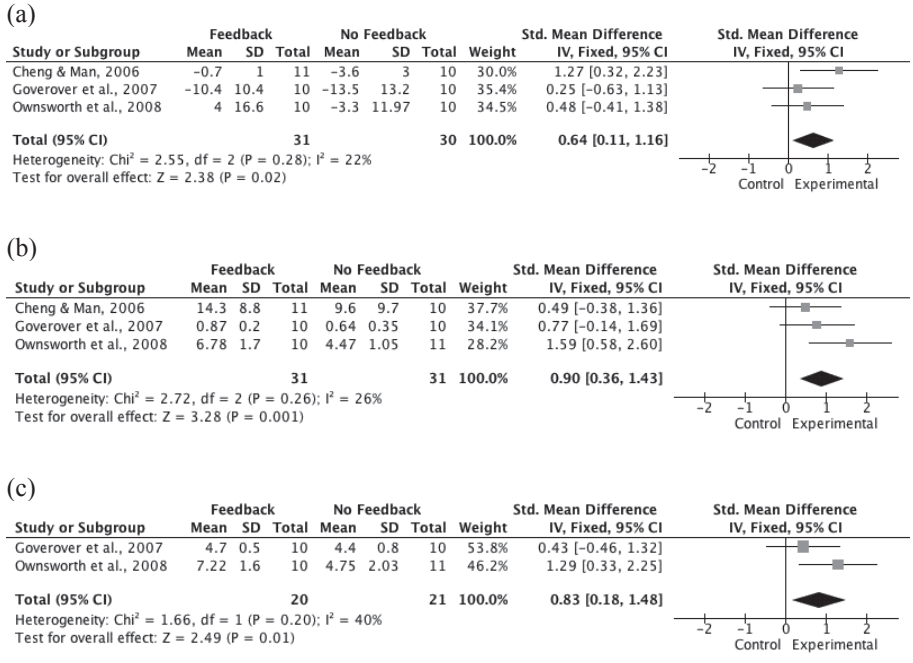

Fig. 2. Data analysis. Effect of feedback on: (a) self-awareness, (b) functional performance, and (c) satisfaction.

improved with statistical significance following interventions involving a feedback component. However, findings from the meta-analysis component of this review are dependent on only 3 clinical trials of varied quality. While meta-analysis yielded moderate to large standardized mean differences on pooling, the small sample sizes and heterogeneity in interventions resulted in wide CIs, thus suggesting that conclusions can only be tentative. The conclusion from this systematic review is that although these data imply that the feedback interventions can significantly improve self-awareness, functional task completion and satisfaction with performance, the current evidence-base on the efficacy of feedback is not substantial enough and further research is recommended. In particular, it is not possible to determine from these studies whether 1 form of feedback is more effective than another. Furthermore, none of the included studies reported a specific and structured feedback protocol used; rather, feedback was a component of a broader intervention for improving self-awareness and functional task completion.

This systematic review used a methodology designed to eliminate potential sources of bias, but this does not guarantee the absence of bias. The review findings may have been biased by publication bias and the inclusion of studies reported in English only. The key limitation of this review is that it includes only 3 randomized controlled trials. The majority of studies in this area are exploratory or use single-case study designs, and there is a lack of high-quality group level trials (21). Without concealed randomization and blinded evaluation of outcome, studies are more likely to show a positive result, and this must be taken into account when reviewing the literature (48). The quality of the included randomized controlled trials, however, was relatively high, scoring a mean of 5.7 out of 10 on the PEDro scale. Particular criteria on the PEDro scale are difficult to satisfy in studies of this nature (e.g. blinding of therapists is difficult or impossible in studies of therapy intervention). The single-case studies reviewed here were mostly of a high quality (mean SCED rating of 7.22 out of 11), and their results consistently reported positive outcomes.

Therefore, in addition to the results of the meta-analysis, the preliminary empirical support for feedback interventions improving self-awareness provides justification for further research in this area. Future randomized controlled trials should be designed to eliminate all types of bias (selection, measurement and intervention bias) and use consistent aspects of measurement for the type of self-awareness that is investigated (on-line or intellectual). In light of the current gaps in health economics in brain injury rehabilitation, future trials should also examine cost-effectiveness. Clinicians would additionally benefit from greater transparency of the content of intervention protocols, the training needed to implement them, and the clinical settings in which they have been evaluated. Assessment of the efficacy of feedback interventions from multiple sources (e.g. the perspectives of people with a brain injury, caregivers and therapists) would provide a more systematic approach for evaluating the clinical utility of such rehabilitation approaches.

ACKNOWLEDGEMENTS

Conflicts of interest: The authors do not have any competing interests in the completion of this study. There is no funding source that assisted with the completion of this study.

REFERENCES

1. Sherer M, Bergloff P, Levin E, High WM Jr, Oden KE, Nick TG. Impaired awareness and employment outcome after traumatic brain injury. J Head Trauma Rehabil 1998; 13: 52–61.
2. Freeland J. Awareness of deficits: a complex interplay of neurological, personality, social and rehabilitation factors. Magazine 1996; 4: 32–34.
3. Barco PP, Crosson B, Bolesta MM, Werts D, Stout R. Levels of awareness and compensation in cognitive rehabilitation. In: Kreutzer JS, Wehman PH, editors. Cognitive rehabilitation for persons with traumatic brain injury: A functional approach. Baltimore, USA: Paul Brookes Publishing Company; 1991, p. 129–146.
4. Prigatano GP. Disturbances of self-awareness of deficit after traumatic brain injury. In: Prigatano GP, Schacter DL, editors. Awareness of deficit after brain injury: clinical and theoretical issues. New York: Oxford University Press; 1991, p. 111–126.
5. Prigatano GP. A brief overview of four principles of neuropsychological rehabilitation. In: Christensen A-L, Uzzell BP, editors, International handbook of neuropsychological rehabilitation: critical issues in neuropsychology. Dordrecht, Netherlands: Kluwer Academic Publishers; 2000, p. 115–125.
6. Schlund MW. Self awareness: effects of feedback and review on verbal self reports and remembering following brain injury. Brain Inj 1999; 13: 375–380.
7. Stuss DT, Anderson VT. The frontal lobes and theory of mind: development concepts from adult focal lesions research. Brain Cognit 2004; 55: 69–83.
8. Bogod NM, Mateer CA, MacDonald SWS. Self-awareness after traumatic brain injury: a comparison of measures and their relationship to executive functions. J Int Neuropsychol Soc 2003; 9: 450–458.
9. Crosson B, Barco PP, Velozo CA, Bolesta MM, et al. Awareness and compensation in postacute head injury rehabilitation. J Head Trauma Rehabil 1989; 4: 46–54.
10. Toglia J, Kirk U. Understanding awareness deficits following brain injury. NeuroRehabilitation 2000; 15: 57–70.
11. O'Keeffe F, Dockree P, Moloney P, et al. Awareness of deficits in traumatic brain injury: a multidimensional approach to assessing metacognitive knowledge and online-awareness. J Int Neuropsychol Soc 2007; 13: 38–49.
12. Wood RL. Long-term outcome of serious traumatic brain injury. Eur J Anaesthesiol Suppl 2008; 42: 115–122.
13. Roche NL, Fleming JM, Shum DH. Self-awareness of prospective memory failure in adults with traumatic brain injury. Brain Inj 2002; 16: 931–945.
14. Ownsworth T, Clare L. The association between awareness deficits and rehabilitation outcome following acquired brain injury. Clin Psychol Rev 2006; 26: 783–795.
15. Fleming J, Strong J. Self-awareness of deficits following acquired brain injury: considerations for rehabilitation. Br J Occup Ther 1995; 58: 55–60.
16. Lam CS, McMahon BT, Priddy DA, Gehred-Schulz A. Deficit awareness and treatment performance among traumatic head injury adults. Brain Inj 1998; 2: 235–242.
17. Flashman LA, McAllister TW. Lack of awareness and its impact in traumatic brain injury. NeuroRehabilitation 2002; 17: 285–296.
18. Katz N, Fleming J, Keren N, Lightbody S, Hartman-Maeir A. Unawareness and/or denial of disability: implications for occupational therapy intervention. Can J Occup Ther 2002; 69: 281–292.
19. Kreutzer J, Wehman, P, Morton MV. Supported employment and

compensatory strategies for enhancing vocational outcome following traumatic brain injury. Brain Inj 1988; 2: 205–223.
20. Berquist TF, Jacket MP. Awareness and goal setting with the traumatically brain injured. Brain Inj 1993; 7: 275–282.
21. Fleming J, Ownsworth T. A review of awareness interventions in brain injury rehabilitation. Neuropsychol Rehabil 2006; 16: 474–500.
22. Ownsworth T, Fleming J, Shum D, Kuipers P, Strong J. Comparison of individual, group and combined intervention formats in a randomized controlled trial for facilitating goal attainment and improving psychosocial function following acquired brain injury. J Rehabil Med 2008; 40: 81–88.
23. Mateer CA. The rehabilitation of executive disorders. In: Stuss DT, Winocur G, Robertson IH, editors. Cognitive neurorehabilitation. New York: Cambridge University Press; 1999, p. 314–332.
24. McGraw-Hunter M, Faw GD, Davis PK. The use of video self-modelling and feedback to teach cooking skills to individuals with traumatic brain injury: a pilot study. Brain Inj 2006; 20: 1061–1068.
25. Alexy WD, Foster M, Baker A. Audio-visual feedback: an exercise in self-awareness for the head injured patient. Cognit Rehabil 1983; 1: 8–10.
26. Ownsworth T, Quinn H, Fleming J, Kendall M, Shum D. Error self-regulation following traumatic brain injury: a single case study evaluation of metacognitive skills training and behavioural practice interventions. Neuropsychol Rehabil 2010; 20: 59–80.
27. Cicerone KD. Psychotherapeutic interventions with traumatically brain-injured patients. Rehabil Psychol 1989; 34: 104–114.
28. DeHope E, Finegan J. The self-determination model: an approach to develop awareness for survivors of traumatic brain injury. NeuroRehabilitation 1999; 13: 3–12.
29. Klonoff PS, O'Brien KP, Prigatano GP, Chiapello DA, Cunningham M. Cognitive retraining after traumatic brain injury and its role in facilitating awareness. J Head Trauma Rehabil 1989; 4: 37–45.
30. Langer KG, Padrone FJ. Psychotherapeutic treatment of awareness in acute rehabilitation of traumatic brain injury. Neuropsychol Rehabil 1992; 2: 59–70.
31. Wiley-Blackwell. Levels of evidence. In Essential Evidence Plus. Available from: http://www.essentialevidenceplus.com/product/ebm_loe.cfm?show=oxford [cited May 20 2009].
32. Higgins JPT, Green S, editors. Cochrane Handbook for Systematic Reviews of Interventions, Version 4 (updated 2010). The Cochrane Collaboration 2010. Available from: www.cochrane-handbook.org [cited May 2010].
33. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med 2009, 6: e1000097. Epub 2009 July 21.
34. Maher CG, Sherrington C, Herbert R, Moseley A, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. Phys Ther 2003; 83: 713–721.
35. Tate RL, McDonald S, Perdices M, Togher L, Schultz R, Savage S. Rating the methodological quality of single-subject designs and n-of-1 trials: introducing the Single-Case Experimental Design (SCED) scale. Neuropsychol Rehabil 2008; 18: 385–401.
36. Hedges LV. Distribution theory for Glass's estimator of effect size and related estimators. J Educ Stat 1981; 6: 107–128.
37. Cohen J. Statistical power analysis for the behavioral sciences. 2nd edn. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.
38. Cheng SKW, Man DWK. Management of impaired self-awareness in persons with traumatic brain injury. Brain Inj 2006; 20: 621–628.
39. Goverover Y, Johnston MV, Toglia J, Deluca J. Treatment to improve self-awareness in persons with acquired brain injury. Brain Inj 2007; 21: 913–923.
40. Fleming J, Lucas S, Lightbody S. Using occupation to facilitate self-awareness in people who have acquired brain injury: a pilot study. Can J Occup Ther 2006; 73: 44–55.
41. Ownsworth T, Fleming J, Desbois J, Strong J, Kuipers P. A metacognitive contextual intervention to enhance error awareness and functional outcome following traumatic brain injury: a single-case experimental design. J Int Neuropsychol Soc 2006; 12: 54–63.
42. Coetzer BR, Corney MJR. Grief and self-awareness following brain injury and the effect of feedback as an intervention. J Cognit Rehabil 2001; 19: 8–14.
43. Rebmann MJ, Hannon R. Treatment of unawareness of memory deficits in adults with brain injury: three case studies. Rehabil Psychol 1995; 40: 279–287.
44. Gajar A, Schloss PJ, Schloss CN, Thompson CK. Effects of feedback and self-monitoring on head trauma youths' conversation skills. J Appl Behav Anal 1984; 17: 353–358.
45. Toglia J, Johnston MV, Goverover Y, Dain B. A multicontext approach to promoting transfer of strategy use and self regulation after brain injury: an exploratory study. Brain Inj 2010; 24: 664–677.
46. Deeks JJ, Dinnes J, D'Amico R, et al. Evaluating non-randomised intervention studies. Health Technol Assess 2003; 7: 1–173.
47. Landa-Gonzalez B. Multicontextual occupational therapy intervention: a case study of traumatic brain injury. Occupat Ther Int 2001; 8: 49–62.
48. Chalmers TC, Celano P, Sacks HS, Smith H. Bias in treatment assignment in controlled clinical trials. N Engl J Med 1983; 309: 1358–1361.