Memory rehabilitation for closed-head injured patients.

Berg, Ina Janny

Summary

Introduction (Chapter 1 & Chapter 2)

The most frequent residual symptom after closed-head injury (CHI) is a memory disorder. Except for the first few months after the injury there appears to be hardly any recovery of memory functioning. Even 10 to 15 years after injury memory deficits can be demonstrated with tests and patients' complaints about forgetfulness do not seem to decrease either in the course of time. Traumatically brain-injured patients perform significantly worse than their healthy peers on almost all kinds of memory tests. Acquisition of information, both verbal and nonverbal, as well as retrieval of information from semantic memory and remote memory is troublesome for CHI-patients.

Two lines of research do suggest, however, that memory performance can be improved. First there are studies from experimental (cognitive) psychology, that show that memory performance is deeply influenced by interest and motivation. Attention, time spent, number of repetitions, organization, depth of processing and the occurrence of interference also appear to be important factors in memory behaviour of normal subjects. Some researchers looked at the facilitating influence of similar manipulations on memory performance of CHI-patients. Maring, Deelman & Brouwer (1986) showed that CHI-patients also profit from lengthening presentation time and organizing the stimulus material. Levin (1989) demonstrated that, also in CHI-patients, deeper processing leads to better memory performance.

The second line of research suggesting that improvement of memory performance is possible, stems from cognitive rehabilitation psychology. The findings of many evaluation studies on the effects of memory strategies in several groups of amnesic patients can be shortly summarized as: in laboratory situations a memory strategy (e.g., imagery, story method) leads to better task performance than no strategy. Though these are promising results, there are some drawbacks to consider if one would want to apply these strategies in a memory rehabilitation programme aimed at improvement of memory functioning in daily life. Often the strategies (as the method of loci or the peg-word system) are artificial, difficult to learn and they require quite some creativity to be applied effectively. Furthermore, often these strategies have limited use in daily life and do hardly generalize to other material. But perhaps the most important objection is that the improvement of performance is not lasting. Effects of training of a specific strategy sometimes disappeared within one week.

The results of evaluation studies that compared a memory rehabilitation programme (mostly with a package of strategies) with a so-called pseudo-treatment (e.g. social skills, computer games, discussion groups) are generally disappointing. Though mostly the patients improved after memory treatment, they did not improve more than the pseudo-trainees.

In our opinion these findings taken together plead for a memory therapy in which simple and broadly applicable strategies are being taught and practice material is provided for by daily life instead of by the laboratory.

Design of the study (Chapter 3)

The study was aimed at the evaluation of the effects of such a memory strategy treatment. The participants in the experiment were 39 CHI-patients, who satisfied the following criteria: a) they were between 18 and 60 years of age, b) the injury had been sustained at least nine months earlier, c) they complained about forgetfulness and d) there had to be objective evidence of memory deficits. Furthermore there had to be no indications of (severe) intellectual, aphasic, apraxic, agnosic or personality disturbances. Besides these patients a small group (N=6) of normal elderly subjects were recruited. They also had subjective and objective memory problems. These healthy subjects all received strategy training.

The patients were randomly assigned to one of three conditions: a) the experimental condition, ***strategy training***, b) a condition to control for Hawthorne effects and effects of practice, the ***pseudo-treatment***, and c) a condition to control for retest effects, ***no-treatment.*** The three patient groups did not differ in age, educational or intellectual level, nor in severity or chronicity of the injury. In view of the mean length of PTA (one month) and time since injury (6 years) this is a group of chronic, severely injured patients, not under medical control or supervision anymore.

In strategy- as well as pseudo-therapy the subjects were individually treated. The treatment took two periods of three weeks, with three one-hour session each week (18 hours in total).

In the ***strategy condition*** six well-known psychological memory principles were discussed and practiced both in laboratory exercises and in daily homework. These strategies were: spend more *attention* and *time* to the memorandum, *repeat* it a few times (with increasing time intervals), try to find *associations*, *organize* and *link the input- and retrieval situation.* The application and practice of these principles was aimed at training targets chosen by the subjects themselves: they indicated which memory problems were most troublesome in daily life and therefor had to be treated. The therapy was thus completely individually tailored, not only regarding the target of training, but also regarding the way the strategies were exercised and applied, in keeping with the strengths, weaknesses, and preferences of the subject.

In the ***pseudo-therapy*** memory games and tasks were practiced and repeated in laboratory session and in homework exercises, without suggesting specific strategies. Only the more general principles of attention, time and (simple) repetition were explained in this group. The patients in this condition spent the same amount of time on treatment and homework as the strategy patients.

The patients in the ***no-treatment*** condition received, as the name might suggest, no treatment, but were assessed as often and with the same time intervals as the other two groups.

The subjects were tested seven times, twice before treatment (PRE), immediately and three weeks after the first training period (POST-1) and immediately, three weeks (POST-2) and four months (FOLLOW-UP) after the second training period. The objective evaluation tasks that were administered on these occasions were divided in three categories, based on the expected effects of the strategy treatment. The battery then consisted of:

1. *Subjective judgements*: The subjects themselves and a relative filled in a questionnaire about everyday memory complaints and one about the training and its effects.
2. *Target-memory tasks*: strategy-sensitive tasks on which generalization of the strategy treatment was expected. We used parallel versions of the 15 Words Test, Name-Face Test and Shopping List Test.
3. *Control memory tasks*: memory tasks on which no strategy-related improvement of performance was expected. (Warrington's RMF, The News Test and Media Information Test).
4. *Control tasks*: memory treatment should not have an effect on reaction times. A reaction time task is sensitive, however, for effects of recovery and increased motivation. A Four-Choice and a Distraction Reaction Time Task were administered.

None of the tests in the evaluation battery was practiced in the treatment.
In the statistical analyses of the test results we used standardised sum-scores. Regression analyses were performed with the score after treatment as criterion, baseline performance as covariate (first predictor) and the conditions as the other predictors.

Patients' results (Chapter 4)

As expected, post-treatment test performance is best predicted by the level at which the subject performed prior to treatment. Only the strategy condition yielded a significant positive extra effect on objective memory performance measures over and above this baseline effect, and that only on strategy sensitive tasks.
Surprisingly, it appears that the largest effect of strategy training was found 4 months after therapy. The effects were somewhat less prominent immediately after the second training period and absent after the first three weeks of training. The finding that the strategy patients performed better at follow-up than immediately after training could be explained by the assumption that the subjects continued to practice the learned strategies in daily life. However, we have no independent evidence for that, else than the remarks of patients that they still used the strategies they had learned during therapy.
Teaching closed-head injured patients to use strategies to overcome their individual daily problems thus seems to generalize to tasks not specifically trained in the therapy. This improvement cannot be ascribed to effects of spontaneous recovery or retest (because the other two groups do not improve), nor to Hawthorne effects or effects of practice (because the pseudo-group does not improve). Nor does an increased motivation seem the cause of the improvement, because then performance on control tasks would also show an increase. Besides this hoped-for pattern, consisting on the one hand of improvement on strategy-sensitive tasks and on the other hand no improvement on control tasks, patients in the strategy condition also subjectively report an improvement in memory functioning. However, and this was not expected, the pseudo-training patients report the same improvement in subjective well-being and are highly satisfied with the treatment. On the memory questionnaire all three groups, also the untreated patients, report a gradual decrease in memory complaints and, again, there is no difference between the groups.

As for the pseudo-treatment: on the objective tests this group improves to the same degree as those who received no treatment but are only repeatedly tested: the effect of drill and practice of memory tasks and games is certainly not larger than simple retest effects.

Results of the normal elderly (Chapter 5)

A group of healthy subjects was incorporated in the study to determine, if effects of strategy training in the patient group would fail to occur, whether this was due to the treatment or the group. In view of the criteria these subjects had to meet (objective deficits in memory and complaints about forgetfulness) only elderly appeared to be eligible.
Though the above positive findings have actually made analysis of the results of these healthy subjects superfluous, the effects of strategy training in CHI-patients and healthy elderly were compared. There was no difference in the 'gain' of the patients and the elderly, they improved to the same extent on the target tasks. Beforehand we predicted that healthy subjects would probably profit more from strategy training than memory-impaired patients. That prediction did not prove to be true, but neither do the results support the pessimistic view encountered in literature that elderly would not be able to learn internal strategies. The elderly are, hardly surprising after the description of the patients' results, very satisfied with the treatment and the effects.

Factors in prognosis (Chapter 6)

To get an impression of the variables that have an influence on the outcome-scores of the patients, several regression analyses were performed. Of the possible candidates, the neurological variables severity and time since injury did, surprisingly, not contribute to the prediction of performance in this very chronic group. Neither did age appear of influence. The only variable with predictive power, besides the already established effects of baseline-level and strategy-dummy, appeared the educational level within the strategy group. Though this suggests that the higher educated patients have the greatest chance of success of strategy training, from inspection of the individual success-cases (according to the Reliable Change Index, Jacobson & Truax, 1991) it appears that among them there also are individuals with a low level of education.

Conclusions (Chapter 7)

The study has shown that the application of simple, well-known memory strategies leads to an improvement of memory performance in CHI-patients and normal elderly subjects. The most gratifying aspect of the results is that we found generalization over both tasks and time. We estimate this form of therapy would be suitable for around a third of all CHI-patients. Important for the efficacy of the treatment seems that subjects are individually treated with training aims for which they are most motivated.
Finally, some methodological conclusion can be drawn from this study for evaluation research: a) summarizing sum-scores sometimes are appreciably more reliable than separate

scores, even of well-known tests; b) an untreated group is necessary for interpretation of improvement in performance, since retest effects appeared to occur even on parallel tasks; c) to be able to measure the effects of a treatment accurately one has to take into account that sometimes these effects may become visible only after a prolonged period, in our study after 4 months. Particularly in research designs in which several therapies are introduced one after another (e.g. single-case design with multiple baseline) the effects of one treatment can thus interfere with the next treatment.