

A Comprehensive Functional Approach to Brain Injury Rehabilitation

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Introduction

Brainwave-R: Cognitive Strategies and Techniques for Brain Injury Rehabilitation (1997) has been designed to assist in the cognitive rehabilitation of individuals with brain injuries. It consists of a large array of exercises (mainly pen and paper based), which are organized into five modules, addressing those areas of cognitive deficit that are most commonly demonstrated following brain injury:

1. Attention
2. Visual Processing
3. Information Processing
4. Memory
5. Executive Functions

The five *Brainwave-R* modules are hierarchically presented according to Luria's (1963) theory of brain function, which suggested that complex behavioral processes are distributed throughout the brain in functional systems. The three basic functional systems have been described by Golden (1981):

1. **Attention** - Level of arousal and maintenance of alertness (mainly involving the brain stem and reticular activating system)
2. **Information Processing** - Reception, integration and analysis of sensory information external and internal to oneself (mainly involving the parietal, temporal and occipital lobes)
3. **Executive Functions** - Planning, executing and verifying of behavior (mainly involving the frontal lobes)

Each of these functional systems is used in most everyday activities, and the three are hierarchically organized. If attention is poor, therefore, information processing and executive functions will consequently be impaired. Also, if problems exist within information processing functions, then it is likely that executive functions will be impaired (Ben-Yishay & Miller, 1983).

Program Description

The *Brainwave-R* program contains the principles upon which the program is based, a general introduction to brain injury and a review of information on each of the cognitive areas addressed in the program. The general introduction to brain injury and the review of information is intended for use by the therapist in educating the client and family. Initial and Final Client Questionnaires are included at the end of the book to help the therapist interview the client. These are described in more detail later.

This introductory book is accompanied by the five modules, each containing a Therapist Workbook and a Client Workbook. The Therapist Workbook includes a list of materials needed for each module, guidelines for the therapist, record sheets for client performance, instructions for how to describe each exercise to the client and answer sheets. The Client Workbook includes exercises to help the client improve performance in the module areas and charts for performance predictions and self-ratings. These exercises aim to educate the client about the problem areas and provide practice opportunities to develop

deficit skills and implement strategies to improve functional performance. The purpose of each module can be summarized as follows:

1. **Attention**—This module aims to develop focused, sustained, selective and alternating attention skills in order to optimize arousal and alertness levels
2. **Visual Processing**—This module aims to develop more accurate saccadic eye movements, visual scanning skills, visual attention, figure-ground discrimination, pattern recognition, visual memory and the ability to mentally manipulate visual information. It also reinforces the exercises on attention completed in the previous module.
3. **Information Processing**—This module is divided into two sections. Part 1 aims to develop ordered, sequenced thinking skills. Part 2 aims to develop the ability to work more quickly, under time constraints and with more complex information.
4. **Memory**—This module has been designed to teach the client about memory processes and emphasizes the use of strategies to compensate for memory problems.
5. **Executive Functions**—This module also has been divided into two sections. Part 1 teaches the client about executive functions and strategies that can be used to compensate for deficits in this area. Part 2 provides a choice of projects for the client to organize, plan and execute using the strategies taught in Part 1.

How to Use the Questionnaires

The questionnaires, which appear at the end of the book, have been included to help the therapist structure the initial and final interviews with the client. These measures focus on functional abilities across a wide range of skills. The initial questionnaire can be used to help determine which of the program modules are appropriate for the client. The final questionnaire can be used to help measure the real-life effects of cognitive rehabilitation efforts. These questionnaires should be used in conjunction with more formalized neuropsychological measures in order to describe patterns of strengths and weaknesses. At present no formalized scoring system has been developed for these questionnaires. The questionnaires may be copied for use with clients.

How to Use the Modules

After the appropriate modules have been selected for the client, the following sequence of events is suggested:

1. The therapist should become familiar with the tasks and should organize any materials that are needed (a list of these for each module are found at the beginning of the Therapist Workbook).
2. The Client Workbook should be opened to the appropriate task and given to the client.
3. The therapist should read the instructions for the task to the client. These spoken instructions appear in boxes in the Therapist Workbooks. Some clients may be able to read and apply the instructions independently, which should be encouraged whenever possible.
4. The client should predict his/her performance using the rating charts

in the Client Workbook. Appropriate rating charts are provided with each exercise.

5. The client should complete (or attempt to complete) the task.
6. The client should rate his/her actual performance using the rating charts in the Client Workbook. Appropriate rating charts are provided with each exercise.
7. The therapist should rate the client's performance using the rating charts in the Therapist Workbook.
8. The therapist should discuss performance with the client, encouraging the client to determine the relevance of the task to his/her everyday life, and to suggest strategies that could be implemented to improve performance.

Repetition of Tasks

Most of the tasks are repeated up to five times, using similar exercises. The purpose of this repetition is to enable the client to monitor improvement following practice and strategy implementation.

Time Involved

The program has been designed to include many opportunities to practice cognitive skill areas. Most of the modules are divided into four weeks, and suggestions are made for which exercises to complete on which days (the exception to this is the Memory module, described below). Suggestions also are made for time duration of each task. There are between 60 and 90 minutes of tasks provided each day, if the suggested time frames are followed. These time frames are merely suggestions, and time will vary depending on the severity of the client's problems and the length of the therapy session.

Therapists are often not able to treat clients for these time frames every day of the week. Clinical experience with this program, however, has shown that clients with mild or moderate injuries can be given up to 60 minutes of tasks to complete outside of therapy sessions without direct therapist supervision, once they understand the task requirements. This "homework" has proven to be a very effective method of working through many of the tasks, and clients report a greater sense of control and involvement in their rehabilitation.

If all the modules are completed within the suggested time frames, the whole program will take approximately seven months to complete.

The Memory Module

The Memory module varies in format from the other four modules. This module is divided into four sections. Sections 1 and 2 consist of learning materials to teach the client about memory and how it works, and inform the client of the range of strategies that are available. Given the different rates at which clients can absorb this information, the sections have not been given time frames. This allows the therapist to control the amount of information given to the client during any one session. Sections 3 and 4 consist of practice exercises and tasks to encourage functional implementation of strategies. These have been divided into weeks with suggestions for timings, as in the other modules.

Metacognition

The processes of knowing which factors influence learning skills and the ability to monitor one's own performance is known as metacognition (Bewick et al., 1995). Metacognitive skills include the processes of awareness, evaluation, prediction, anticipation and self-control (Brown et al., 1983; Flavell, 1985). The inclusion of metacognitive processes in cognitive rehabilitation is considered to be an essential feature of a successful program (Ben-Yishay & Diller, 1993; Bewick et al., 1995). The aim is for the client to be an active participant in the cognitive rehabilita-

tion program. The *Brainwave-R* program has been designed to incorporate a strong metacognitive component, including the following:

- An educational emphasis, to teach the client about cognitive skill areas and how to use strategies to improve functioning
- Study questions to test acquisition of knowledge
- Rating charts on which the client predicts performance and rates actual performance
- A performance summary sheet that allows therapist and client to compare ratings in order to improve accuracy of prediction and self-evaluation
- Ideas to stimulate the client to determine the relevance and purpose of each task

Who is the Program For?

The tasks and strategies contained in the *Brainwave-R* program are ideally suited to adult clients of varied ages who have mild to moderate cognitive deficits following brain injury. Many of the tasks, however, also can be used with clients who have more severe problems. The therapist may use the modules as resource books in order to customize appropriate activities for certain clients, and may decide to select only specific tasks with children who have brain injuries. The *Brainwave-R* program can be used in various settings:

- Inpatient rehabilitation programs
- Outpatient rehabilitation programs
- Community-based or outreach programs
- Family/client support groups (e.g., Brain Injury Association [United States], Headway [United Kingdom])

Ways to Use the Program

The *Brainwave-R* program has been designed to be flexible so that the therapist can use it in various ways according to the individual needs of the client. The following are some suggested methods:

1. As a whole cognitive rehabilitation program, beginning with the Attention module, progressing through Visual Processing, Information Processing and Memory modules, and ending with the Executive Functions module
2. Use of selected modules to meet the individualized needs of the client
3. As a cognitive activities resource bank from which the therapist can select appropriate tasks from a number of different modules to suit the needs of the client

Principles of Brainwave-R

The following principles of brain injury rehabilitation form the basis of *Brainwave-R*:

Principle 1—*It is possible to overcome or optimize the effects of cognitive deficits to enable the individual to become a better problem solver in real-life situations* (Ben-Yishay, 1981; Ben-Yishay et al., 1982; Ben-Yishay & Diller, 1983). Although compensation may be viewed as occurring spontaneously, it can be carried further by direct treatment and education (Prigatano, 1986; Zangwill, 1947). Functional improvements may occur up to 10 to 15 years or more post-injury (Sbordone, 1990).

Principle 2—*Rehabilitation combines treatment and educational processes*. In the treatment process, specialists work on a client; in the educational process, specialists work with the client and his/her family (Romano, 1984). The former is a passive model, whereas the latter is an active participating model. A client's active participation in a program is a necessary condition for successful rehabilitation (Askensay & Rahmani, 1987). The former model makes it more difficult for the person with a brain injury to develop appropriate executive and psychosocial skills because it does not focus on self-initiation and decision making.

Principle 3—Structured activities can ameliorate some of the emotional and adjustment difficulties that occur following brain injury. Clients frequently become inactive, particularly if left to themselves, because their inability to organize themselves is often dysfunctional (Ruff & Niemann, 1990). They also may develop social and familial problems due to the increased behavioral disturbances, such as social isolation, loneliness and frustration, that their condition imposes on them (Cole, Cope & Cervelli, 1985). These problems occur as the result of organic (brain-related) and/or functional (psychological) consequences post-injury.

Structure imposed from outside will help the person with a brain injury deal more effectively with life's demands. Over time this structure may be internalized and used spontaneously, thus obviating the need for further intensive intervention. Consistency is the key to therapy for people with brain injuries. The client's day must be structured in a predictable, logical and consistent manner (Slade, 1985).

Principle 4—Continued appropriate programs of cognitive stimulation will lead to better recovery. Environmental stimulation will lead to greater brain weight, increased neuronal size, prolific dendritic growth and more glial cells (Powell, 1981). Despite skepticism about the "practice makes perfect" principle among neuropsychologists, there is no evidence that this model does not have some effect on improvements (Gianutsos, 1991). Until evidence indicates to the contrary, it is wise to include mental stimulation in a cognitive rehabilitation program, particularly because traditional learning models support such activity.

The value of training and exercise has long been recognized in the rehabilitation and education of mental functions. In fact, as a process in itself, doing exercises can be a powerful antidote to depression (Gianutsos, 1991).

Principle 5—The first goal is to reduce the client's generalized cognitive confusion. This means optimizing the individual's attention and information processing skills to make him/her more efficient. Therapy should focus on capacity and flexibility of information processing (Hart & Hayden, 1986).

Principle 6—Developing awareness and acceptance of strengths and deficits is an important part of the process (Askensay & Rahmani, 1987; Prigatano, 1986). There is a constant need to deal with the client's poor awareness and appraisal of problems (Prigatano, 1986). Minimally, therapists should be able to help people identify their cognitive losses. Additionally, therapists can help clients to come to terms with these losses and develop coping methods. Finally, therapists can attempt to help clients regain lost function (Gianutsos, 1980).

Principle 7—Therapy should aim to restore real-life abilities rather than abstract skills. Thus, cognitive rehabilitation is important primarily for its effects on interpersonal, leisure and work and/or productive skills (adaptations). Tasks are not chosen for content but to serve primarily as vehicles for the transmission of strategies (Scherzer, 1986). Neuropsychological testing should be supplemented by neurobehavioral assessment, including detailed medical and background histories, family and social relationship information, and behavioral observations (Sbordone, 1990). This constitutes a neuropsychological evaluation. Following this evaluation, cognitive rehabilitation should be geared toward:

- Daily life functions and self-care
- Skill complexes that have a direct bearing on work abilities
- Interpersonal skills and social readaptability (Ben-Yishay & Diller, 1983).

Principle 8—Active participation by family members in the rehabilitation

process should be encouraged. Family members should be taught rehabilitation management strategies (Sbordone, 1990). The family needs systematic aid from trained professionals in helping the client achieve his/her highest level. Comclair (1989) reported that 50% of caregivers experience significant levels of general psychological distress and impairment in family functioning after a family member sustains a brain injury. These levels of distress are strongly associated with behavioral, cognitive, somatic, communicative and social problems. Emotional distress can be reduced by having problem-focused coping methods, perception of a greater cohesion and emotional expressiveness in the family, and a more positive attitude (Bryan, 1990). The family's adaptation to the injury and its sequelae has a significant impact on the rehabilitation of the person with a brain injury (Bond & Brooks, 1976).

Despite this distress, families usually wish to continue supporting and caring for a person who is injured (Oddy et al., 1985). Thus, it is appropriate that the client is treated as part of the family unit (Sbordone, 1990) and, consequently, that he/she be treated as close to home as possible (Eames et al, 1989). Often family members also require counseling to help them adjust to the individual's stages of recovery.

Principle 9—Clients should be encouraged to maintain appropriate eating and sleeping habits. These patterns often are disturbed after brain injury. Good sleep is essential to avoid catastrophic reaction due to fatigue and metabolic changes (Sbordone, 1990). If needed, a daily calorie and sleep log can be kept.

Principle 10—Long-term rehabilitation is necessary after brain injury. Long-term follow-up studies of individuals with untreated brain injury have shown that without therapy many individuals do not continue to progress (Brooks et al., 1986; Lezak, 1979; McKinlay et al., 1981; Oddy, Humphrey & Uttley, 1978). In fact, Brooks and colleagues (1986) estimated that as many as 50% get worse, developing psychiatric, behavioral and social complications, and becoming an increasing burden on their caregivers.

Principle 11—Generalization of skills occurs over an extended period of time along with specific attempts to help the process (Cicerone, 1987). Generalizations of learning to real-life functions have been programmed into the *Brainwave-R* study pack. Generalizations to more general cognitive functioning do not seem to occur unless specifically built into a program. Treatments aimed solely at primary cognitive deficits do little other than change functioning specifically on the treated measures (Brooks, 1991).

Principle 12—Executive functions need to be incorporated into a brain injury rehabilitation program. Disturbances of higher executive functions (initiation, planning and self-regulation) may be especially prominent after brain injury and frequently determine the extent of social and vocational recovery (Oddy et al., 1985).

Principle 13—This program is based on Luria's (1963) theory of plasticity (the "reorganization of functional systems") and is structured in accordance with his elucidated principles. Following a brain injury, specific functions (i.e., language, memory, sensorimotor abilities) may be altered. A reorganization of brain functions may occur through "uninjured" brain areas, allowing then-altered functions to be performed differently.

Principle 14—Tasks are presented in modular form, building from each other over the course of the program. Barth and Boll (1981) stated that tasks should:

- Be structured from simple to complex
- Be objectively quantified
- Lend themselves to immediate client feedback

Principle 15—Instructions within the program are presented clearly and concisely. The format is highly organized and user friendly.

Principle 16—The program may lead to greater readiness for productive activities (educational/vocational), enhanced personal satisfaction, more constructive use of leisure time and improved social relationships. Some programs and therapists focus solely on vocational abilities as an outcome goal. This focus is important but not sufficient and does not address all of the problems. The balance should include work, activities of daily living (ADLs) and leisure skills. If clients are to function at their maximum, their feelings about leisure and its use cannot be left to chance or accident. Rather, it must be part of the rehabilitation process (Hein-Farley, 1983).

Principle 17—An educational component has been incorporated into the program so that the client can learn about the effects of brain injury on different aspects of adaptive functioning. This information is written in a clear and concise manner, and is comprehensive and can be maintained as a reference.

Principle 18—Considering that the field of brain injury rehabilitation has not been fully researched, this program may be viewed as current and flexible in its approach, so that new research findings easily can be incorporated into the overall design as well as the techniques used.

Conclusion

The rehabilitation of individuals who have sustained any form of brain injury continues to be an arduous task. It is time consuming, expensive and frequently physically and emotionally draining for the individual as well as to significant others. Cognitive strategies and techniques, as provided in the *Brainwave-R* program, can offer a practical contribution to enhancing functional adaptive skills in daily living. Successful implementation of such strategies should minimize the amount of time, money and frustration often reported during brain injury rehabilitation. According to Hartlage (1998), this comprehensive approach to brain injury rehabilitation "can certainly enhance the repertoire, scope and comprehensiveness of facility-based neurological rehabilitation programs, by providing therapists with a wide and useful array of well conceived and carefully designed procedures."

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Thomas L. (Tim) Bennett, PhD, ABPP, is a Professor Emeritus of psychology at Colorado State University where, in 1996, he was named the University Honored Scientist by Sigma Xi. He was named the distinguished graduate educator by the College of Natural Sciences in 1998. He is clinical director of the multidisciplinary Brain Injury Recovery Program at Fort Collins, CO. He is the author and/or co-author of more than 135 publications including *Brain and Behavior* (1977), *The Sensory World: An Introduction to Sensation and Perception* (1978), *The Psychology of Learning and Memory* (1979), *Introduction to Physiological Psychology* (1982), *The Neuropsychology of Epilepsy* (1992), *Brainwave-R: Cognitive Strategies and Techniques for Brain Injury Rehabilitation* (1997) and *Psychology Video Teaching Modules: The Brain* (Second edition, 1997). He is board certified in neuropsychology by the American Board of Professional Neuropsychology and in rehabilitation psychology by the American Board of Professional Psychology. He is currently president of the American Board of Professional Neuropsychology. In the past, he has served as a member of the board of directors and the annual conference coordinator for the National Academy of Neuropsychology. He is a fellow of the National Academy of Neuropsychology, the

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