Issues in Cognitive Rehabilitation

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Abstrak.
Upaya untuk mengembalikan gangguan berpikir pada manusia telah tercatat sepanjang sejarah, dari teknik alamiah hingga pendekatan neuropsikologi kognitif. Saat ini, upaya rehabilitasi kognitif telah dikembangkan untuk mengoptimalkan fungsi otak pasca trauma otak. Namun, masih terdapat beberapa isu kunci yang harus ditangani dalam memahami efektivitas rehabilitasi kognitif seperti: apakah proses kognitif yang kompleks dapat ditingkatkan dengan pelatihan dan apakah metode tersebut memiliki dampak berarti pada fungsi individual. Beberapa isu efektivitas rehabilitasi kognitif yang diperoleh dari beberapa review penelitian juga akan didiskusikan dalam tulisan ini.

Kata Kunci: *Neuropsikologi, rehabilitasi kognitif, fungsi individual*

Abstract.
The attempts to restore impaired human thinking have been recorded through out the history; from the natural techniques to the advance cognitive neuropsychology approach. Nowadays, cognitive rehabilitation efforts have been developed to optimalize brain functions after brain trauma. However, there are still many key issues that should be addressed in understanding the effectivity of cognitive rehabilitation, such as: whether the complex cognitive process can be improved by training and whether these methods used have a meaningful impact on individual functioning. Moreover, confounding results of several cognitive rehabilitation studies are also found. Thus this paper would confer some issues about the effectivity of cognitive rehabilitation by discussion gained from a review of evidence-based research.

Keywords: *Neuropsychology, cognitive rehabilitation, individual functioning*

The term cognitive rehabilitation covers a variety of interventions aimed to increase self regulation of cognitive abilities, behavior and mood, and also the sense of self efficacy of individuals with cognitive impairment. Cognition is considered as a highly complex set of function interactions, where the mechanisms underlying the cognitive processes are still difficult to be comprehended and intervened explicitly, even in normal functioning individuals; therefore current rehabilitation approach more focus in improving the residual function and compensating the impaired cognitive abilities (Sohlberg & Mateer, 2001). In doing so, cognitive rehabilitation combines the knowledge about the nature of cognitive disorders from cognitive psychology and the learning models (Baddeley, 1993). Generally, there are four main goals in cognitive rehabilitation: restoration of damaged function, optimalization of residual functions, compensation for lost function, and substitution of intact function (Glisky & Glisky, 2002).

Fussey (1990) further explains that cognitive rehabilitation as a therapeutic method providing learning and exercise processes via two main learning process; procedural and declarative

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learning. Procedural learning process outlines how learned physical behaviors are obtained slowly through practices, while declarative learning focus on improving individuals understanding by increasing awareness of their situations.

Declarative learning is closely related to cognitive approach because this model emphasizes upon thinking and its mediation to behavior. Client with disrupted cognitive functioning are guided to make verbal self regulation to govern their behaviors (Ellis, 1984 as cited in Fussey, 1990). It may seems that this approach would not be appropriate for people with severe cognitive disruption due to the lack of insight, however since this cognitive treatments proved to have influenced merely on mild to moderate brain dysfunction, therefore cognitive component is still can be considered as an integrative cognitive and behavioral treatment for cognitive rehabilitation in mild cognitive deficit. Burgess & Alderman (1990) found inhibition improvement in a traumatic brain injury (TBI) patient with verbal abuse problem as the result of implementation of response cost program which involved important cognitive component. This study justified the importance of cognitive component in cognitive rehabilitation.

Procedural learning approach forms the basis that any learned skill is obtained gradually by rehearsal and practice. Many of the current cognitive rehabilitation method are based from this step by step practice. Procedural approach can be differentiated into two specific techniques, information processing and skill building. Information processing focuses on improving the specific cognition capacity for the benefit of functional outcomes, whereas skill building focuses on defining and regenerating specific skills or behaviors to alleviate cognitive problems (Fussey, 1990). For example, on treating patient with memory disorder, information processing technique would focus on improving memory ability then planning, training and evaluating for generalization of the use of this improved memory capacity; while the skill building technique would be focused on defining what specific memory impairment occurred and also what is the appropriate skill that should be generated. These two approaches are the common techniques used in cognitive rehabilitation. In order to elaborate how these techniques and procedures used in cognitive rehabilitation, this essay will focus on how the skill building and function improvement approaches are applied in the current intervention of attention, memory and executive function impairments.

Cognitive rehabilitation of Attention, Memory and Executive function

Strong attending of cognitive rehabilitation is placed on treating attention, memory and executive function, because of the significant influence of these capacities in human functioning (Sohlberg & Mateer, 2001). In each cognitive rehabilitation approach would consists with assessment procedure for identifying neuropsychological problems, management strategies and evaluation for determining the best treatment approach for a particular problem. Cognitive rehabilitation assessment is aimed to obtain an accurate picture of the individual's cognitive, emotional and interpersonal functioning, including the premorbid and residual function after a cognitive impairment; to estimate the adequate treatment goal according to individual's limitation and strength; and also to make suggestion of the appropriate management strategies for facilitating learning and cognitive improvement. Moreover, assessments are also needed in evaluating the efficacy and outcome of applied treatment during a period of time.

Then, the procedure will be followed by intervention. Intervention strategies are usually developed based on specific theoretical explanation, for example: management of attention deficit would depend on what particular attention problem occurred. It is important to have some theoretical or conceptual framework of cognitive processes nature in rehabilitation approach, thus the intervention would be more focused and effective. However it should be noted that most of the cognitive rehabilitation are never based on a single-strategy, but it require combination of different approaches for attending the diverse problems in one's life caused by neuropsychological problem (Sohlberg & Mateer, 2001). Finally, the effectiveness of rehabilitation interventions should be evaluated. This procedure

was considered to be very important in order to understand the treatment has resulted on improvement that is consistent and meaningful to the life of an individual. The information gained form evaluation studies could be used as guidance for further study and also as an important consideration for both professionals and patients for making decision on the field of mental health.

Much of evaluation information about cognitive rehabilitation strategies and its effectivity can be gained via article reviews and also meta-analysis studies on cognitive rehabilitation. After reviewing some evidence-based research on cognitive rehabilitation; further this paper would discuss cognitive rehabilitation on attention, memory and executive function. Each cognitive component will be discussed in term of its measurement, intervention and evaluation strategies which had been used widely in clinical neuropsychology field.

Attention

Attention can be defined an ability to hold objects, events, words, or thoughts in consciousness (Ylvisaker, 1998). In clinical setting, attention is explained into five components: focused, sustained, selective, alternating and divided attention; this classification serves as a framework for the assessment and management strategy of impaired attention.

1. Assessment of attention

There were several data collection strategies that can be applied to obtain of individuals' basal attention capacity. However, sometimes there would not be sufficient time to administer all neuropsychological battery, therefore clinician need to select and prioritize the selected assessment based on their diagnosis and previous data collection.

a. Standardized tests: the Test of Everyday Attention (TEA; Robertson, Ward, Ridgeway & Nimmo-Smith, 1996); the Attention Rating and Monitoring Scale (ARMS; Cicerone, 2002)

b. Ecological measures of impairment in individual's daily life: the Attention Questioners (Sohlberg et al., 1994); the Dysexecutive Questionaires (DEX; Burgess e al., 1996); the Brock Adaptive Functioning Questionnaires (BAFQ; Dywan & Segalowitz, 1996)

c. Structured interview with the client and caregivers (e.g. parents, teacher) to collect information about changes in attention functioning following the cognitive intervention.

d. Observation of relevant behavior may be the most useful however may also be time consuming and subjective. It is proposed combination of interview and observation would be appropriate to have actual performance on specific attention dependent tasks, such as driving skill or academic skill.

e. Anecdotal reports, clinician make a description of differences of client's global functioning such as independent living in pre and post treatment and frequency of use of external aid. This report would give sufficient means to evaluate client progression over time.

2. Management of attention disorders

Sohlberg & Mateer (2001) classified four approaches in addressing problems in attention:

a. *Attention process training (APT)*. This method involves the use of cognitive exercises that are designed to improve attentional ability by stimulating a particular aspect of attention. Table 1 illustrates the specific task used to stimulate certain attention components. However, training component may also be applied to skill specific tasks, such as attention in driving. This treatment efficacy is evaluated by monitoring the clients' changes in their ability to perform the training task, the psychometric tests results and also everyday functioning.

b. *Use of strategies and environmental support*. This strategies use the self compensatory strategies for attention problems and also environmental supports. Self management strategies generates self instructional schedule to help client to focus their

attention. Environmental support relies on modification or reorganization client's physical environment in order to reduce the load of attention distractors.

c. *Use of external aids*. This strategy uses various aids to help individual in organizing and keep in track with information, such as: day planner, electronics organizer, message recorder and task specific devices (e.g. key finders and watch alarm).

d. *Psychosocial support*. This approach addresses the emotional and social factor that may result from attention deficit by decreasing the level of client's anxiety and also improving client's self efficacy.

Attention deficit management strategies should be individualized programmed. Moreover, these approaches positively need the collaboration with caregivers and client's significant others as the environmental supports and also serve as the base for implementation monitoring.

Table 1. Attention process trainings for sustained, selective, alternating and divided attention components

Attention components	Definition	Practice
Sustained attention	Ability to maintain attention over time during continuous activity	Listening to a tape recorded sequence on attention tapes, and pressing a buzzer when the target is identified
		Visual scanning exercises
	Ability holding and manipulating information	Listening to a tape recorded stimulus
Selective attention	Freedom from distractibility	Visual scanning with background distractor noise or movement
		Visual scanning with overlays (eg a plastic overhead sheet with distactor lines) on top of a paper an pencil activity
Alternating attention	Capacity for mental flexibility	Listening to a tape recorded target word or sentence on attention tapes, and then switching to listening for a different type of word or sequence
		Visual scanning pencil task that require alternating between generating numbers or letters that comes before or after the presented target in a number line or alphabet
		Listening to a tape recorded number then designate then switches between adding and subtracting selected number
Divided attention	Ability to respond to two task simultaneously	Visual scanning simultaneously scanning for a target word (e.g. while reading, client has to count the number of ands)
		Visual scanning simultaneously performing a reaction time computer task
		Visual scanning tracking elapsed time) while simultaneously engaging in a sustained attention activity

This table is adapted from Sohlberg & Mateer (2001).

3. Evaluation

Sohlberg et al. (2000) reported the positive changes on self report and the score improvement on neuropsychological measures in 14 patients with acquired brain injury after APT. There were also many studies conducted to evaluate the impact of rehabilitation strategies in improving attention abilities. Limond and Leeke (20005) reviewed the evidences of the attention training effectiveness in patients with acquired brain injury and found generally treatments are improving attention capacity (Butler & Copeland, 2002; Thomson, 1995), even influencing executive function (Thomson & Kerns, 2000).

Memory

Memory refers to the information that are stored in the brain and also to the process of acquiring and retrieving such information (Damasio & Tranel, 1995). Memory is a set processes (Sohlberg & Mateer, 2001) which can be differentiated based on the phases of acquiring information (e.g. encoding, storage and retrieval); based on time dependent process (e.g. short term and long term memory); based on the content dependent forms (e.g. declarative and non declarative); and based on the mean of daily functioning (e.g. prospective and metamemory). Given that the aim of cognitive rehabilitation is to improve human daily functioning and the prospective memory incorporates the practical model in explaining everyday memory functioning; this memory model explains the ability to remember to perform out our intentions; therefore understanding prospective memory impairment and training point up the memory intervention.

1. Assessment of memory

Assessment of memory capacity before cognitive rehabilitation is conducted in order: to understand the nature of memory impairment, to predict recovery and everyday adjustment, to select type of memory intervention, and to evaluate treatment effectiveness for memory intervention (Kapur, 2005). There three main sources of evidence for the assessment of memory functioning in clinical settings:

a. Clinical interviews with the client, family and caregivers, enquire about the precipitating accidents or illness and problems manifested in everyday life.
b. Behavioural data, such as questionnaires, rating scales, and checklists of memory behaviour recorded by patient, family or other health care staff in clinical settings. These observations may be a part of the treatment process itself.
c. Memory tests, such as Adult Memory and Information Processing Battery, California Verbal Learning Test (CVLT), and Wechsler Memory Scale-III (WMS-III); the pattern-location memory subtest of the Cambridge Computerised Cognitive Testing Battery (CANTAB).

Memory assessment procedure should consists a combination of clinical interview data, behavioral observations and formal memory testing in order to obtain detailed information of client's current memory capacity.

2. Management of memory impairment

Sohlberg & Mateer (2001) proposed the restorative memory intervention (e.g. memory practice drills and mnemonic strategy training) and also the domain-specific memory intervention (e.g. mnemonic strategy for specific information) to improve memory capacity. However, there was only little evidence that proved rehabilitation could restore the impaired memory function (Wilson, 1998; Cicerone, 2005), therefore compensation strategies are still the practical solution in memory intervention.

a. *Memory aid*. This approach stresses on the importance of external aid such as a paging system, to reduce the everyday memory and planning problems of people with organic memory deficits (Wilson et al., 2001). Paging system is very simple to use, the system will transmit messages to the individual pager or use modem to transfer messages into a computer. It is important to make the patients make the most use of this device every time.
b. *Errorless Learning*. This method stresses on the learning process that avoid learner to make a guess (trial and error) where the learning condition and learning stimuli have

been conditioned so that patients would less likely to generate failure.

3. Evaluation

The use of external aid as a compensation strategy to memory impairment showed significant influence in client's daily functioning (Wilson et al., 1994). NeuroPage (a paging system) significantly reduced everyday memory and planning failures in people with brain injury; with more than 80% of those who completed the 16 week trial were significantly more successful in carrying out everyday activities in comparison with the baseline period. This compensation strategy is widely used in clinical setting due to its long term effect.

Baddeley & Wilson (1994) proved that amnesic patients would make less failure to remember if they were prevented from making mistakes in learning process. Clare et al. (2000 as cited in Wilson, 1998) used errorless learning in combination with other strategies such as spaced retrieval and vanishing cues, to teach everyday information to people with Alzheimer's disease (AD). These study results confirmed that errorless learning resulted on superior performance than in the trial and error learning. Moreover, these memory compensatory program need to ensure active participation from the client.

Executive function

Executive function covers a wide range of voluntary and spontaneous skills that are necessary for problem solving in novel situations when the routine behaviours cannot comply with the new task demand. Norman & Shallice (1986 as cited in Sohlberg & Mateer, 2001) appointed several components underlying the complex executive function, they are: initiation, response inhibition, task persistence, organization, generative thinking, and self monitoring. These components cover the broad range of executive influence in behaviour and cognitive process, therefore many of executive tests are developed in order to measure these underlying components.

1. Assessment of Executive function
   a. Standardized clinical psychology tests which provide the explicit instruction and a rigid structure in directing client during the task performance. However, these tests are still insensitive to measure executive function then allow clients with dysexecutive syndrome to perform well and cover the actual executive impairment. These clinical tests proposed to measure attention, memory, fluency and problem solving, e.g. Wisconsin Card Sorting Test (WCST); and fluency tests (verbal and design fluency).
   b. Interview to client and significant others about the behavior and personality changes during and after the cognitive treatment.
   c. Measurements of executive performance by using tasks that place demands on frontal lobe abilities, e.g. the Profile of the Executive Control System (PRO-EX); and the Executive Function Route Finding Task (ERFT).
   d. Dysexecutive questionnaires to enquire everyday executive problems, e.g. the Dys-Executive Questionnaire (DEX); the Brock Adaptive Functioning Questionnaires (BAFQ); and the Behavioral Rating Inventory of Executive Functioning (BRIEF).

2. Management of executive function
   a. Compensatory interventions by building skills derived from the dysexecutive function, for example the problem solving (Von Cramon et al., 1991); goal management training (Manly et al., 2002); where these skill trainings are aimed to monitor self performance and to reduce the goal neglect.
   b. Interventions with attempts to improve specific component of executive dysfunction, for example the self instructional training and the self regulating training for impulsivity (Suzman et al., 1997 as cited in Limond & Leeke, 2005).
   c. Pharmacological approaches have been used to enhance executive functioning. Several studies results showed that Dopaminergic (DA), Norepinephrine (NE) and Noradrenergic (NA)

neurotransmitter systems implicated in modulation of the pre-frontal cortex. For example: there was evidence of improvement in attention and executive functioning in individuals with Attention Deficit Hyperactivity Disorders (ADHD), though the use of Methylphenidate, which increases level of DA and NE (Mehta, Sahakian and Robbins 2001); and also some evidence for improving planning and fluency tasks performance with Idazoxan (an alpha2 antagonist, which acts pre-synaptically to increase NA) in cases of frontal dementia (Coull et al. 1996 as cited in Whyte, 2003).

3. Evaluation

A huge number of difficulties result from brain insult have been associated with executive dysfunction, but there was only small number of evidence that proved the effectiveness of executive function intervention. Therefore it is difficult to conclude with conviction that the cognitive interventions promote executive function recovery and restoration from neural circuit damage. Although there were evidence that suggested these compensatory and skill building strategies are influential in improving clients on task performance, however they also proved to have limited impact on social functioning. While the pharmacotherapy approach confirmed to have a positive effect on people's functioning, however this approach too did not restore the damaged circuits. Therefore, more research studies should be conducted in order to reveal the appropriateness and efficacy of cognitive rehabilitation program for executive functioning.

DISCUSSION

Issues in cognitive rehabilitation

Due to many perspectives developed in cognitive rehabilitation field, several confounding results are also occurring that may raise questions about cognitive rehabilitation effectivity, such that: compensation versus restoration, natural changes overtime on childhood versus adulthood, and global stimulation versus specific cognitive treatment.

Compensation versus Restoration

What is the main underlying mechanism of cognitive rehabilitation? Although the compensation and substitution of the lost function approaches have dominated the cognitive rehabilitation techniques, however there are new techniques developed from restoration of damaged function and optimalization of residual functions approaches. Lillie and Mateer (2006) proposed the Constraint-based Therapy for Cognitive Rehabilitation (CTCR). This method directly focuses on recovering the affected function by constraining the intact functional function which leads to increase the uses and practices of the impaired function. Jennings & Jacoby (2003, as cited in Lillie & Mateer, 2006) applied this procedure in memory training to aging individuals by restraining familiarity or automatic memory so the individuals would rely on exercising the memory processing or conscious recollection; and they found the significant improvement over time. Unlike its precursor in motor movement treatment, CTCR approach still need to console its procedural limitations, such as: challenging effort to restrain cognitive function to enforce the use of affected function. Despite of the limitations of and the scarce of efficacy evidence, however, this new developed technique should be considered as a model in cognitive rehabilitation. This approach is grounded from neural plasticity paradigm, which stated restitution is possible after brain lesions. However, Wilson (1998) confirmed that restoration approach would only be appropriate for relatively mild brain impairment, whereas compensatory processes are more suitable for larger lesions treatment.

Natural changes overtime: childhood onset and adult onset injury

Questions are often raised over whether young brain is less susceptible to damage; or may be more vulnerable than the later onset injuries. Due to neuroplasticity and compensation strategies, recovery progression has been observed to occur over time in childhood onset acquired brain injury (Sciavetto et al., 1997). In opposite, there also evidence suggested early injury impact would be more apparent in a few years after the injury and might result on a cumulative effect in

further development, for example: greater consequences and long term intellectual impairment because of traumatic brain injury were found to be more severe in infants and younger children than in school-aged children and adolescence (Lange et al., 1979 in Ylvisaker, 1998; Middleton, 2001). In line with this, Limond & Leeke (2005) conducted a review study of cognitive rehabilitation in pediatric settings and found that while there were some individual cases improvements but there were no convincing effectiveness evidence of cognitive rehabilitation for children with required brain injury. This problem is also being complicated by certain biological and psychological vulnerabilities that affect children's ability in certain age; therefore there is the need to develop and deliver the appropriate treatment for certain developmental period.

Although there was no conclusive answer to this controversy yet, however cognitive rehabilitation in children should conduct more effortful treatment attempts due to childhood critical developments (Ylvisaker, 1998). Also Sohlberg & Mateer (2001) stressed on the importance of ongoing assessment, in order to track children development or residual of brain injury effects. Also, as family play a critical role in rehabilitation process with children, therefore the treatment approach should concern on familial positive influence and cooperation. Adult's brain is viewed as more restricted in cerebral plasticity; however, Wilson (1998) explained that natural recovery over time may occur in children and also in adults. Wilson et al. (2001) also found that the significant memory improvement in daily activities due to memory aid program is not affected by age and suggested that children as well as adult patients were able to use external memory aid in order to complete certain task.

Global stimulation versus Specific cognitive treatment

Is there any difference of efficacy between global stimulation and specific cognitive treatment? There were several attempts to answer this question. Farinamd (2006) compared the recreational activities (global stimulation) with a combination of procedural memory training on activities of daily living and neuropsychological rehabilitation of residual functions (cognitive-specific) in mild to moderate Alzheimer's disease (AD) patients for six weeks; and they found that there were no significant different between these two approaches. Although it is not conclusively agreed, but up to now the effectivity of cognitive treatment is more influenced but there are other factors that are more influential in treatment recovery, such that, Wilson (1998) listed several important factors: the severity of insult, the number of insult, the age at time of insult, premorbid cognitive status of brain, the extent to which one function can be substituted by other function, integrity of the rest of the brain, individual idiosyncrasies of intact brain structures, patient motivation and emotional factors, and lastly the extent and quality of rehabilitation.

CONCLUSION

This discussion has revealed the effectiveness of cognitive rehabilitation strategies of attention, memory and executive function. Issues in cognitive rehabilitation have expanded general clinical neuropsychology practices. Moreover, the success of rehabilitation programs is depend on the importance of a sound theoretical framework for the understanding the nature of the problems and the appropriate treatment procedure for specific impairment. Finally, more research studies should be conducted in order to reveal the appropriateness and efficacy of various cognitive rehabilitation programs.

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