

## Cognitive Rehabilitation: Current Trends

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### ABSTRACT:

*Cognitive rehabilitation (CR) is a therapeutic approach designed to improve cognitive functioning after central nervous system insult. It includes an assembly of therapy methods that retrain or alleviate problems caused by deficits in attention, visual processing, language, memory, reasoning, problem solving, and executive functions. There have been evidences to prove that cognitive rehabilitation plays a major role in restoration of the cognitive functioning. There are various approaches for this but nowadays various new techniques are added so that the success rate increases. Various Indian studies are being carried on this area.*

**Key words:** *Cognitive rehabilitation, cognition.*

### INTRODUCTION

The care of people with mental and behavioral disorder has always reflected prevailing social values related to the social perception of mental illness. Impairment cognitive functions are a significant cause of disability after brain injury and stroke which often leads to residual deficits in the physical and psychological spheres. Cognitive rehabilitation (CR) is a therapeutic approach designed to improve cognitive functioning after central nervous system insult. It includes an assembly of therapy methods that retrain or alleviate problems caused by deficits in attention, visual processing, language, memory, reasoning, problem solving, and executive functions (Sohlberg & Mateer 2001). CR consists of tasks designed to reinforce or re-establish previously learned patterns of behavior or to establish new compensatory mechanisms for impaired neurological systems. Cognitive rehabilitation may be performed by a physician, psychologist, or a physical, occupational, or speech therapist. Cognitive rehabilitation can be defined as an intervention in which patients and their families work with health professionals to restore or compensate for cognitive deficits hereby improving the patient's everyday functioning

### APPROACHES IN COGNITIVE RHABILITATION

Cognitive rehabilitation is a systematic, goal-oriented treatment program aimed at improving cognitive functions and to increase the level of self-management and independence after brain damage.. Here described some of the earlier approaches to cognitive rehabilitation.

Goldstien (1942) proposed behaviour therapy as a way of managing cognitive deficits. In which patients were treated by training discrete behaviours related to the cognitive areas of memory, perceptual ability, language, and motor skills. Token economy served as a supplementary strategy for motivating the patient to continue the program.

In 1986, Prigatano put forth a four step process which combines psychosocial and neuropsychological interventions for cognitive recovery. The steps were:

- 1) Reducing the generalized cognitive confusion by systematically helping patients to improve their attention skills.
- 2) Through individual and group counselling patients are made aware of their strengths and weakness.
- 3) Patients are helped to recognize the need for compensatory behaviours and in final step, cognitive deficits are addressed, and followed by that there emerged some programs like General Stimulation Approach, Functional Adaptation Approach, Restorative approach or Compensatory approach.

A small description is provided in the following table;

APPROACH	TECHNIQUES USED	PRINCIPLE
General Stimulation Approach	Cognitive retraining workbooks or microcomputer programs etc	Stimulation of cognitive processing will result in improvement in mental functions

Functional Adaptation Approach	Training provided in a naturalistic or living situation	Cognitive functioning cannot be improved with specific retraining hence it should be carried out in a wholly functional context
Restorative Approach (AHRO, 1999)	Auditory, visual and verbal stimulation and practice, number manipulation, computer-assisted stimulation and practice, performance feedback, reinforcement, video feedback	Repetitive exercise serves as restorative function. Mainly targets the improvement of internal cognitive processes with a goal of generalizing improvements in real-world environments.
Compensatory Approach	Visual cues, written instructions, memory notebooks, watches, beepers, computers and other electronic devices to trigger behaviour	It aims at developing external assistance and encourages and reinforces an individual's remaining strengths.

Besides this there are some other approaches or techniques that are used in cognitive rehabilitation, such as environmental interventions, which mainly focuses on changing aspects of the injured individual's environment so as to reduce behavioural and functional impairments (Sohlberg & Mateer, 2001).

## NEW TECHNIQUES

There are some new techniques that have found their way in the rehabilitation programs

**A) Virtual Reality-** Virtual reality (VR) can be viewed as an advanced computer interface that allows the user to interact and become immersed within computer-generated simulated environments. Although media hype may have oversold it's potential at this early stage in the technology's development, a uniquely suited match exists in its application to cognitive assessment and rehabilitation. Through its capacity to create dynamic multisensory, 'real-life' stimulus environments, within which all behavioral responding can be recorded. Its importance has now been recognized as a new tool for the study, assessment, and rehabilitation of cognitive processes (Rizzo and Buckwalter, 1997)

**B) Drama technique -** The use of drama techniques in the therapy of individuals with traumatic head injuries is a new addition to cognitive rehabilitation. The success of a pilot programme using drama techniques as a means of

developing the social-communication, cognitive and motor skills of individuals with head injuries points the way to a new and useful cognitive rehabilitation tool (Stensrud et al., 2006)

**C) Posit science's Brain fitness program-** The Brain Fitness Program features six computer-based exercises for use on a PC or Mac. These exercises speed up and sharpen how the brain processes and remembers sounds. Scientific studies show the Brain Fitness Program helps you in a) Remember more of what you hear b) Keep up with conversations (even in noisy places) with friends and family, at work, while volunteering, etc. c) Pick up more details in conversation, music, movies, and every sound-rich setting d)The exercises adapt to individual level, and give constant feedback about progress. The program is easy to use, even for computer novices.

**D) Music therapy:** It consist of using music therapeutically to address physical, psychological, cognitive or social functioning for patient of all ages. Because music therapy is a powerful and non-invasive medium, unique outcomes are possible. Available European literature suggests that music therapy is capable of alleviating poor executive functioning in schizophrenia (Glicksohn & Cohen 2000) music induced reduction in arousal enabling patients to allocate more attention to task in hand.

**E) Direct instruction (DI):** Instruction is an essential component of effective cognitive rehabilitation, which requires teaching or re-teaching a variety of skills and concepts to people with compromised learning. Currently, the field lacks a cohesive set of principles to guide clinicians' instructional behaviours. A review of the literature in related fields, in conjunction with findings in neuropsychology, reveals evidence-based principles that lead to effective instructional design and implementation (Sohlberg et al., 2000). Case studies suggest that Direct Instruction is a promising approach for teaching both academic and behavioral skills to students with TBI.

## EVIDENCE BASED STUDIES OF EFFICACY IN VARIOUS DISORDER:-

**Traumatic Brain Injury (TBI):** Various studies was done where cognitive rehabilitation was used in.

Cicerone (2004) conducted a nonrandomized, controlled intervention trial to evaluate the effectiveness of an intensive cognitive rehabilitation program compared to a standard neuro-rehabilitation program for patients with TBI. The Intensive group exhibited a significant treatment

effect compared to the standard neuro-rehabilitation program group. The Intensive group patients were more than twice as likely to show clinically significant improvement in community integration. Salazar et al. (2000) worked with moderate-to-severe closed head injury people to an intensive eight-week inpatient cognitive rehabilitation program or a limited home rehabilitation program that included weekly telephone support from a psychiatric nurse. Outcome measures used included return to gainful employment and fitness for military duty at a one-year follow-up. They concluded that the overall benefit of in-hospital cognitive rehabilitation for patients with moderate-to-severe TBI was similar to that of home rehabilitation. Ninety percent of the hospital group was able to return to work compared to 94% of the home group. Fitness for active military duty was 73% for the hospital group and 66% for the home group. Patient-selection criteria (relatively young, previously healthy, well-oriented military personnel) make it difficult to generalize these findings to a broader population.

**Cerebrovascular Accident (CVA)/Stroke:** Several Cochrane systematic reviews have evaluated the effectiveness of cognitive rehabilitation following stroke. Lincoln et al. (2001) evaluated the use of cognitive rehabilitation for attention deficits following stroke indicated that cognitive rehabilitation may improve alertness and sustained attention, although the evidence could not support or refute its use to improve functional independence. A Cochrane review on cognitive rehabilitation for spatial neglect following stroke concluded that, although there is a growing number of cognitive rehabilitation approaches that show promise on standardized neglect tests, there is insufficient unbiased evidence to support or refute the effectiveness of either bottom-up or top-down approaches. It was stated that, although the number of neglect rehabilitation trials is rising, there are insufficient high quality randomized controlled trials with appropriate functional outcome measures to allow confident recommendations for clinical practice (Bowen et al., 2002).

**Dementia:** Clare and Woods (2007), reported on the effectiveness of cognitive training (guided practice on a set of tasks that reflect particular cognitive functions) and cognitive rehabilitation (developing strategies and methods of compensating based on individual needs and goals) interventions on patients with Alzheimer's disease and vascular dementia. Nine randomized controlled trials (RCTs) were identified for cognitive training, and no RCTs were identified for cognitive rehabilitation. They reported no significant differences between cognitive training and

control were found. To conclude, it was stated that, based on the evidence reviewed, there was no evidence supporting the efficacy of cognitive training and insufficient evidence to evaluate the effectiveness of cognitive rehabilitation in Alzheimer's disease and vascular dementia.

**Alzheimer's Disease:** In a meta-analysis of the literature regarding cognitive training (CT) and Alzheimer's disease, Sitzer et al. (2006) reviewed 19 controlled trials, 14 of which were RCTs. A small effect size for CT in general was reported but, more specifically, there were negative or minimal effects on visuospatial functioning and language, small effects on motor speed and visual learning, medium effects on executive functioning, and large effects on verbal and visual learning. Only a few studies reported follow-up data suggesting that gains may be maintained an average of 4.5 months after discontinuing treatment. Many limitations in the studies were identified such as: the limited number of well-controlled studies, small sample sizes, and the variable outcome measures and techniques used. They concluded that CT may improve the cognitive and functional abilities of patients with Alzheimer's disease, but further research is needed, including effectiveness studies in various settings and the use of performance-based measures to evaluate the effects of treatment on daily functioning.

**Schizophrenia:** McGurk et al. (2007) conducted a meta-analysis of 26 randomized controlled trials that evaluated the effects of cognitive remediation on cognitive performance, symptoms and psychosocial functioning in 1,151 patients with schizophrenia. It was found that impact of cognitive remediation on function was moderated by several factors including the addition of adjunctive psychiatric rehabilitation, cognitive training method, and patient age. It was concluded that cognitive remediation may have a moderate effect on cognitive performance and when combined with psychiatric rehabilitation, may improve functional outcomes. Velligan et al. (2006) examined research findings on the eight evidence-based approaches to cognitive rehabilitation. The eight approaches included: attention process training, integrated psychological therapy, cognitive enhancement therapy, neurocognitive enhancement therapy, cognitive remediation therapy, the neuropsychological educational approach to remediation, errorless learning approaches, and attention shaping. According to them, the studies that were included varied considerably in areas such as criteria for study inclusion, the conceptual organization of studies, and interpretation of findings. They stated that few approaches had more than three data-based studies

supporting their efficacy in schizophrenia and that there are no agreed upon guidelines for levels of intensity or duration of training. They findings of this review were not uniformly positive but encouraging, which is what they would expect at this stage of cognitive rehabilitation development.

### **COGNITIVE REHABILITATION IN CHILDREN AND ELDERLY: A FRESH OUTLOOK**

**Children with brain injuries-** It is not uncommon to see children with brain injuries worsen cognitively and behaviourally as they grow into the late adolescence and young adulthood unless they receive cognitive rehabilitation therapy throughout their developmental years. In one study, 33 post-secondary students with learning disabilities proofread self-generated written language samples under three conditions: (1) using a speech synthesis program that simultaneously highlighted words on a monitor and audibly "spoke" them; (2) having text read aloud by another person; and (3) receiving no assistance. Subjects detected a significantly higher percentage of errors when using speech synthesis compared to either of the other conditions. In particular, subjects detected a significantly higher percentage of capitalisation, spelling, usage, and typographical errors with speech synthesis. Subjects may have detected more errors with computer assistance than with human assistance because a person reading the text aloud may subconsciously correct errors when reading aloud; the novelty of the computer may have increased motivation in that condition; and the visual highlighting may have provided an additional benefit unavailable with the human assistant (Raskind et al., 1999).

**Elderly population-** New frontiers of cognitive rehabilitation in geriatric age: the Mozart Effect (ME). The ME was described for the first time in 1993. Subsequently other studies with similar designs were performed. The present study, therefore, proposes: (i) to verify the existence of the benefits of exposure to music in elderly subjects with mild cognitive impairment (MCI), (ii) to explore whether it is possible to find any lasting improvement after training, conducted for a long period of time, with such musical pieces, in the measurable cognitive performances. The study conducted showed that the ME is present in geriatric patients with MCI; the influence on spatial-temporal abilities remains constant in time if the stimulation is maintained. The continuation of this study will consist of increasing the number of individuals examined and in having them listen to music during the study of ECG rhythms and during the acquisition of cerebral functional magnetic resonance imaging

(fMRI), and, at the same time, testing them by neuropsychometric methods (Cacciafesta et al., 2010).

### **DOES COGNITIVE REHABILITATION PLAY ANY PROPHYLACTIC ROLE?**

There have been evidences to prove that cognitive rehabilitation plays a major role. Consistency of behavioral and neural changes after focused cognitive rehabilitation in patients with mild cognitive impairment was seen. These focused interventions have significantly improved the accuracy of memory and reaction time for the trained associations, with the benefits persisting for at least 1 month. Analysis of the fMRI data has consistently revealed increased encoding-related activation within a widespread cerebral cortical network primarily involving medial frontoparietal and lateral tempoparietal areas (i.e. portions of the default network). Additionally, training has resulted in increased effective connectivity between many of these regions. In a study of the benefits of a multi-component cognitive rehabilitation program in patients with mild cognitive impairment it was found that these people showed significant improvement on activities of daily living, mood, verbal and non-verbal episodic memory performance (Kurz et al., 2008). Rozzini et al (2006) reported that subjects without treatment maintained their cognitive functional and behavioural status after one year; patients treated with only cholinesterase inhibitors improved in depressive symptoms whereas those treated with a combination of cognitive training and cholinesterase inhibitors showed significant improvements in different cognitive areas, such as memory, abstract reasoning and in behavioural disturbances particularly depressive symptoms, in regard to efficacy of cognitive rehabilitation in patients with mild cognitive impairment treated with cholinesterase inhibitors.

### **FACTORS AFFECTING REHABILITATION OUTCOME;**

**Neurological symptoms:** The location, size and type of lesion are the critical determinants of cognitive consequences and the likelihood of recovery. The natural history of TBI recovery depends on whether the head injury is diffuse or focal, with recovery from diffuse injury following a more stereotypic course (coma, posttraumatic amnesia (PTA), post acute recovery from focal injury being more dependent on the lesion location and size (Katz and Mills 1999). Coma severity, coma duration and PTA duration have been identified as significant predictors of functional outcome from diffuse TBI.

**Neuropsychological status;** A comprehensive neuropsychological evaluation is recommended to determine which skills have been compromised and need to be rehabilitated versus which skill survive and can be recruited to compensate the lost functioning (Caetano & Christensen, 1997). Deficits in executive functioning and sustained attention pose particular challenges for the patient's ability to engage in effortful, extended cognitive rehabilitation and to reintegrate in social and vocational activities. Nevertheless it must be noted that most standard neuropsychological tests assess cognitive impairment rather than disabilities. Hence, they are poor predictors of functional outcome, particularly when neuropsychological functioning is assessed in the post-acute stage of recovery. More ecological neuropsychological tests have been devised in recent years are more predictive of everyday functioning (Burgess et al 1998 ; Schwartz and Macmillon 1989; Wilson 1991).

**Psychosocial factors;** It is widely known that psychosocial status and lifestyle affect cognitive function in vulnerable population and that such factors are taken into account in developing treatment programs. Prigatano (1999) has conducted considerable research on the importance of patient's awareness of their functional disabilities and on the relationship between awareness and their ability to benefit from rehabilitation. Poor awareness can lead to passive or resistant behaviour in therapeutic setting. Different approaches have been taken to help improve awareness and motivation. Patients and family education about common sequelae of brain injury (Anderson 1996), record of patient's behaviour (through logs or videotape) to provide the patient with a more objective view of the behaviour (Mateer, 1999) psychotherapy to help patients cope with their disabilities (Ben-Yishay & Diller, 1993; Prigatano 1999) and psychological problems, including worry, anxiety, depression are commonly associated with brain injury (Morton & Welmon, 1995, Prigatano, 1999). It is well established that emotional problems negatively effects cognitive functions (Fields et al., 1998), but cognitive deficits has also been shown to relate with social functioning, satisfaction with lifestyle and optimism (Dawson et al., 1999). These findings led to widespread agreement that problems with these need to be addressed as part of a comprehensive cognitive rehabilitation programme (Prigatano 1999; Wilson 1995).

**Background history and support:** The patient's background characteristics and social supports play an important role in rehabilitation outcome, yet, with the exception of patient's age, they are rarely integrated into rehabilitation therapies or outcome evaluation in a objective way. A recent study demonstrated the importance of premorbid patient's characteristics found that patient with

poor outcome following mild TBI were likely to have had past neurological and psychiatric problems and other life stressor (Ponsford et al., 2000). Similarly, a number of study has documented reduction in patients social support network following TBI (Morton & Welman, 1995) ,reduction that may negatively affect recovery outcome (Lezak, 1995). To address these needs, Ruff and Camenzuli (1991) recommended a multi-axial classification system to help identify factors that may influence rehabilitation outcome. It includes premorbid and current emotional, psychological, and vocational status, factors that should be considered prior to establishing outcome goals and expectations.

#### INDIAN EXPERIENCES:

Cognitive rehabilitation is implemented as a treatment program for patients with head injury, since past fourteen years in our country. It was started by attempting restoration of function. In an experience with over two hundred patients, it has been found to be effective for improving post concussion syndrome, memory deficits and even frontal lobe deficits following head injury (Rao et al., 1995). In NIMHANS, home based cognitive remediation program was developed, which incorporates the functions of attention and memory. In this program, the therapist would teach a task to a care giver on a weekly basis. The patient's relative or friend would administer these tasks to the patients at home (Sarkar et al., 1996) Methods of restoration on detoxified alcoholics with residual memory deficits have been tried. Patients showed improvements in their planning ability and in their memory (Mathai et al., 1994)

In children with attention deficit hyperactivity disorder cognitive rehabilitation has been used to improve their functioning. As a result, it was seen that their attention span increased, impulsivity reduced and school performance also improved (Aggarwal, 1992). In a study conducted on the role of cognitive and vocational retraining in chronic schizophrenic patients it was found that there were significant differences in the pre and post assessment in the areas like attention, memory, executive functioning and problem solving but no significant difference in vocational part (Pandey, et al., 2006). Various studies are still in progress in India and work is been carried out to see the effect of cognitive rehabilitation in various fields.

#### CONCLUSION

The development of cognitive rehabilitation interventions reflects a growing recognition that cognitive recovery is possible. At the same time, there is little evidence for the effectiveness of existing interventions that goes beyond the demonstration of small effect sizes,

let alone for cognitive rehabilitation's durability or generalizability. We argued that in order for the field to advance, cognitive interventions must incorporate a number of other features. It must also be recognized that significant cognitive recovery can occur through the use of structured interventions, and living and treatment environments in general, and possibly through medication. Therefore, a focus on maximizing cognitive recovery through whatever means (or combination thereof) are possible should replace a focus on single interventions in future research and practice. Paradoxically, in moving ahead in these ways, the future of cognitive rehabilitation will be making use of insights that date back to Kraepelin but that have yet to be used for systematically promoting cognitive change.

## REFERENCES

1. Aggarwal, N & Rao, S.L.(1992).Neuropsychological remediation in hyperkinetic syndrome,46<sup>th</sup> Annual National Conference of Indian Psychiatric Society, New Delhi.
2. Anderson, S.W. (1996). Neuropsychological rehabilitation in closed head injury. In Rizzo M, & Tranel D, (Eds.),*Head Injury and Post Concussion Syndrome*, Churchill Livingstone, New York, NY.
3. Ben-Yishay, Y.& Diller, L. (1993). Cognitive remediation in traumatic brain injury: Update and issues, *Archives of Physical Medicine and Rehabilitation*, 74,204-213.
4. Bowen, A., Lincoln, N.B., Dewey, M.(2002). Cognitive rehabilitation for spatial neglect following stroke, *Cochrane Database Syst Rev*, Feb15,(2).
5. Burgess, J., Harrison, C. M., Filius, P. (1998). 'Environmental Communication and the cultural politics of environmental citizenship', *Environment and Planning A*, vol. 30, pp. 1445-1460.
6. Cacciafesta M. et al., (2010). New frontiers of cognitive rehabilitation in geriatric age: the Mozart Effect (ME) *Arch Gerontol Geriatr.* (in press)
7. Camenzuli, L. F. (1991). Research challenges for behavioral rehabilitation. Searching for solutions, In: Kreutzer, J.S. & Wehman, P.H, *Cognitive rehabilitation for persons with traumatic brain injury*, Imaginart Press, Bisbee, Arizona.
8. Christensen, A.L. & Castano, C.(1997). Contributions to neuropsychological rehabilitation, *Neuropsychological Rehabilitation*, 6, 279-303.
9. Cicerone, K. D., Mott, T., Azulay, J., et al.(2004). Community integration and satisfaction with functioning after intensive cognitive rehabilitation for traumatic brain injury, *Arch Phys Med Rehabil*, 943-50.
10. Clare, L. & Woods, R.T. (2007). Cognitive rehabilitation & cognitive training for early stage alzheimer's disease & vascular dementia, *Cochrane database syst. Review*.
11. Dawson, D., Winocur, G., & Moscovitch, M. (1999). The psychological environment and cognitive rehabilitation in the elderly. In: D.T. Stuss, G Winocur & I.H. Robertson (Eds.), *Cognitive neurorehabilitation*, Cambridge University Press ,pp, 94-108.
12. Field, C.D., Galletly, C., Anderson, D.,et al.(1998). Computeraided cognitive rehabilitation: possible application to the attentional deficit of schizophrenia, a report of negative results, *Percept Mot Skills*, 85, 995-100.
13. Goldstein, K. (1942). *After effects of brain injuries in war: their evaluation and treatment; the application of psychologic methods in the clinic*, Grune & Stratton, New York.
14. Glicksohn, J., & Cohen, Y., (2000). Can music alleviate cognitive dysfunction in schizophrenia, *Psychopathology*, 33, 43-47.
15. Katz, D.I. & Mills, V.M. (1999). Cognitive rehabilitation "traumatic brain injury: natural history and efficacy of cognitive rehabilitation", Cambridge university press , 279-301.
16. Kurtz, A., Poh, C., Ramsenthaler, M., et al., (2008). Cognitive rehabilitation in patients with mild cognitive impairment, *International journal of geriatric psychiatry*, vol 24, issue 2, 163-168.
17. Lezak, M.D. (1995). *Neuropsychological Assessment*, 3rd Edition, New York: Oxford University Press, pp,1,026.
18. Lincoln, N.B., Majid, M.J., Weyman, N. (2001).Cognitive rehabilitation for attention deficits following stroke. *Cochrane Database Syst Rev*. Updated 2008 Aug 3.
19. Mateer, C.A.(1999). The rehabilitation of executive disorder. In: *Cognitive neurorehabilitation* (eds.), D. T. Stuss, G Winocur and I.H. Robertson, Cambridge, New York, pp. 314-32.
20. Mathai G, Rao S.L., & Gopinath P.S., (1994). Neuropsychological Rehabilitation in alcoholics 46<sup>th</sup> Annual National conference of Indian Psychiatric Society, Madras

21. McGurk, S.R., Twamley, E.W., Sitzer, D.I., et al. (2007). A meta-analysis of cognitive remediation in schizophrenia, *Am J Psychiatry*, Dec; 164.(12), 1791-802.
22. Morton, M. V. & Wehman, P. (1995). Psychosocial and emotional sequelae of individuals with traumatic brain injury: a literature review and recommendations, *Brain Injury*, 9, 81-92.
23. Pandey, S., Nizami, S.H., & Singh, A.R., (2006). Role of Cognitive Training on Vocational Training; Unpublished Ph.D. Thesis, submitted to Ranchi University.
24. Ponsford, J., Willimott, C., Rothwell, A., et al. (2000). Factors influencing outcome following mild traumatic brain injuries in adults, *Journal of the International Neuropsychology Society*, 6, 568-579.
25. Prigatano G.P. (1986). *Neuropsychologische rehabilitation*, Springer-Verlag, Berlin
26. Prigatano, G.P. (1999). Disorder of self – awareness after brain injury. In: G.P. Prigatano (ed.), *principles of neuropsychological rehabilitation*, New York: Oxford University press, pp, 265-293.
27. Rao S.L., Gangadhar B.N., & Hegde A.S., (1995). Remedying Information Processing deficits in post concussion syndrome through cognitive restraining. A case study, *NIMHANS Journal*.
28. Raskind M.H., Goldberg R.J., & Higgins E.L., (1999). Patterns of change and predictors of success in individuals with learning disabilities: Results from a twenty-year longitudinal study, *Learning Disabilities Research & Practice*, 14:35.
29. Rizzo, A., & Buckwalter J. G. (1997). Virtual reality and cognitive assessment and rehabilitation: The state of art. In: Riva G.(eds), *Virtual Reality in Neuro-Psycho-Physiology: Cognitive, Clinical, and Methodological Issues in Assessment and Rehabilitation*, Amsterdam, IOS Press, 123-146.
30. Rozzini, L., Costardi, D., Barbara, V.C., et al., (2006). Efficacy of Cognitive rehabilitation in patients with mild cognitive impairment treated with cholinesterase inhibitors, *International journal of Gesiate psychiatry*, Vol 22, Issue 4, 35-360.
31. Salazar, M.D., Deborah, L., Warden, M.D., et al (2000), Cognitive Rehabilitation for Traumatic Brain Injury :A Randomized Trial , *Journal of American Medical Association*, Vol, 283(23),3075-3081.
32. Sarkar, A., & Rao, S.L., (1996). Home base cognitive remediation in post concussion syndrome ,48th Annual National conference of Indian Psychiatric Society, Bangalore
33. Schwartz, A.F. & McMillan, T.M. (1989). Assessment of everyday memory after severe head injury, *Cortex*, 25, 665-671.
34. Sitzer, D.I., Twamley, E.W., Jeste, D.V., (2006). Cognitive training in Alzheimer's disease: a meta-analysis of the literature, *Acta Psychiatrica Scandinavica*, 75-90.
35. Sohlberg, M. M., Mateer, C. A. (2001). An integrative neuropsychological approach, pp. 21, The Guilford Press, New York.
36. Sohlberg M. M., McLaughlin K., Pavese A., et al (2000). Evaluation of attention process training and brain injury education in persons with acquired brain injury. *Journal of Clinical and Experimental Neuropsychology*, 22, 656-676.
37. Stensrud, C., Mishki, L., Craft C, et al., (2006). the use of drama technique in cognitive rehabilitation, *Therapeutic Rehabilitation Journal*.
38. Velligan, D.I., Kern, R.S., Gold, J.M. (2006) Cognitive rehabilitation for schizophrenia and the putative role of motivation and expectancies. *Schizophrenia Bulletin*, 32, 474-485.
39. Wilson, B. A. (1995). Memory rehabilitation: Compensating for memory problems. In Dixon, R. A., and B'ackman, L. (eds.), *Compensating for Psychological Deficits and Declines: Managing Losses and Promoting Gains*, Lawrence Erlbaum Associates, Mahwah, NJ , pp, 171-190.
40. Wilson, B.A. (1991). Long term prognosis of patients with severe memory disorders, *Neuropsychological Rehabilitation*, 1, 117-134.

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