Article *NIMHANS Journal*

Remedying Information Processing Deficits in Post Concussion Syndrome through Cognitive Retraining - A Case Study

Volume: 03 Issue: 02 July 1985 Page: 151-153

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Abstract

Information processing deficits have been aetiopathogenetically related to the symptoms of post concussion syndrome. A cognitive retraining program consisting of recognition threshold training, reaction time training and parallel processing training was developed, to correct the information processing deficits. A 22 year old male patient with post concussion syndrome who underwent this cognitive retraining program showed improvement in the information processing deficits, and reduction of symptoms.

Key words -
Post Concussion Syndrome,
Information processing deficits,
Cognitive retraining

Forty three percent of patients with closed head injuries develop post concussion syndrome [1]. An association between deficits on tests of information processing and post concussion syndrome (PCS) has been demonstrated using either auditory [2] or visual stimuli [3]. The deficits have been located both at the level of stimulus processing and response programming stages [2]. A slowing of information processing resulting in an information overload has been suggested as being aetiopathogenetically related to symptoms of PCS [3]. Thus correction of the deficits in information processing by way of cognitive retraining was thought of to alleviate these symptoms. Following is such a model designed in a visual information processing training program which was effectively administered to one patient.

Training Procedure

Training was in three stages i.e., recognition threshold training, reaction time training and training in parallel processing. Each session of the recognition threshold training consisted of three blocks, an initial assessment block and two shaping blocks with a pause of 2 minutes in between. In the assessment block, the patient was asked to recognize by pressing the appropriate button, one of the four single digits (2, 3, 5 & 6) which appeared in the center of the visual display unit of the computer

system. The digits appeared ten times in each of these durations i.e., 20, 40, 80, 160, 380, 640, 1280 or 2560 milli seconds. The order of the digit and the stimulus durations were assigned randomly without the knowledge of the patient. After this the first shaping block of eighty trials start at the threshold stimulus duration i.e., the duration at which 70 percent of the stimuli were correctly recognised. In these trials for each correct identification a single auditory feed back bleep was given the stimulus duration was reduced by one millisecond. This proceeded till the 20 millisecond stimulus duration after which only auditory feedback for correct identification was maintained. The second shaping block of eighty trials started at the nearest threshold duration at which the patient had reached 70 percent accuracy. The sessions were terminated when the accuracy reached 80 percent in the shaping blocks, for the lowest stimulus dimention i.e., 20 millisecond.

In the reaction time training sessions the patient was asked to press the appropriate button as quickly as possible (the reaction time) after the stimulus of 20 milliseconds duration disappears. Two auditory feedback bleeps occurred if the recognition was accurate and the reaction time had improved from the previous trial. Five such sessions each lasting 1 hour were given.

Training was extended to improve parallel processing. Parallel processing here refers to identification of as many as possible, of the nine single digits, displayed for 200 milliseconds, as random arrays of three rows and columns. Stimulus duration in each trial was reduced successively by one second upto a minimum of 10 milliseconds, and the patient was persuaded to recognize as many digits as possible. One of the first five of the seven sessions the initial stimulus duration was reduced by 20 milliseconds each. Each session had eighty shaping trails. The last three sessions starting at 120 milliseconds stimulus duration.

A twenty four year old male engineer met with a traffic accident and had sustained cerebral concussion. He was unconscious for half an hour and had no neurological deficits or ENT bleeding at the time of injury. He was referred to the post trauma clinic for treatment as he had persisted PCS symptom. The symptoms as described by the patient was noted down. The patient rated each symptom on a ten point scale before the training and once at the end of every tenth session. Table 1 gives the figures for the symptom intensity and the scores on the tests. The reduction in the number and severity of symptoms with improvement in the test scores is evident. Following the termination of training the patient was followed up at one year during which the performance on test and the clinical state essentially remained well maintained.

Table I - Symptom Intensity and Scores of Tests

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Discussion

Correction of information processing deficits appears to have a beneficial effect on the symptoms of PCS. Though earlier, techniques to correct neuropsychological deficits have been reported [4], [5] these focus on correction of specific deficits, such as memory through imagery training [6], unilateral spatial reflect [7] and defective vision [8]. To our knowledge, correction of neuropsychological deficits has not been earlier reported in association with improvement in PCS symptoms. The training model although promising warrants further clinical inquiry in open and blind clinical trails.

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