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REACTION TIME DEFICITS IN POST TRAUMATIC SYNDROME

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SUMMARY

8 patients with closed head injury with post concussional symptoms were compared with normal on both simple and choice reaction time. The choice reaction time was significantly prolonged in the head injury patients although in four patients the symptoms had lasted over 2 years after the head injury, indicating an etiological relationship to post traumatic syndrome.

Recent investigations into the etiological factors of post traumatic syndrome (PTS) have identified information processing deficits as an organic etiological factor (Gronwall and Wrightson 1974). Reaction time (RT) becomes an important component of information processing, as it indexes speed of stimulus processing and response programming, R.T., particularly the choice R.T. has been found to be slower in patients with head injury (Norrman & Svahn, 1961 ; Gronwall & Sampson, 1974 ; Van Zomeren & Deelman, 1978 ; Fenton, 1983). Though the nature of R.T. after head injury has been studied, the relation between protracted R.T. & P.T.S. has not been examined. In view of the advantage offered by the sequential analysis of information processing, the nature of information processing deficits in PTS would be better understood by identifying deficits at the different stages of information processing. Delays in stimulus processing and response programming can have an independent or joint effect of R.T. Analysis of speed accuracy trade offs in the R.T. paradigm offer powerful tools to find the relative contributions of stimulus processing and response programming to the total R.T.

The nature of R.T. in PTS has been examined in the present study, under the simple & choice R.T. paradigms, using the speed-accuracy trade off analysis.

Methodology

Sample : 8 patients (3 of whom were females) who had suffered a closed head injury, without any haematoma or depressed skull fracture selected from the post traumatic clinic of the National Institute of Mental Health and Neurosciences formed the patient group. Age range was from 24 to 40 yrs., with durations of symptoms ranging from 4 months to 5 ½ yrs. with a median of 2 yrs. Severity of head injury identified by the length of unconsciousness ranged from nil to 48 hrs. with a median of 10 mms. A diagnosis of post traumatic syndrome was made on the following criteria. a) Symptoms occuring after head injury, b) duration

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of symptoms for at least 3 months, c) at least three of the following symptoms, i.e. headache, dizziness, anxiety, depression, irritability, poor memory and concentration, fatiguality, insomnia and intolerance to noise. 4 of the patients were on sedative medication.

8 subjects biologically unrelated to the patients and who had no clinical signs of neurological or psychiatric illness, comparable to the patient group in age range and sex ration formed the control group. The subjects had normal or corrected normal vision.

Design: PSI action station computer with peripherals was programmed to deliver the stimuli and record the responses. Stimuli were single digits 14 mm high and 9 mm wide displayed singly on the centre of a visual unit screen and viewed centrally from a distance of 5 ft.

Simple R. T. Paradigm: Stimulus was the digit 2.80 exptl. trials followed 80 practice trials with a 5 minute rest in between. On each trial lasting 4 secs, a fixation point appeared in the first second on the screen centre, 250 ms. after which the stimulus appeared for 80 ms. Subject was required to press a button (same button on all trials) immediately after the stimulus disappeared. Mean R.T. of the exptl. trials was the score. *Choice R.T. Paradigm.:* Stimuli were the digits 2, 3, 5 & 6, each of which on 5 trials, lasted for 20, 40, 60 & 80 ms. 2 sets of 80 exptl. trials followed 2 sets of 80 practice trials with a rest period of 5 ms. between each set. In each set, the order of stimuli & durations was randomized such that the stimulus occurred at each duration 20 times. Nature of the trials was identical to the simple R.T. paradigm, excepting that the subject was required to press one of 4 buttons corresponding to the stimulus. Score consisted of Mean R.T. of correct responses at each stimulus duration.

Results

The Mean R.T. in the simple R.T. paradigm were 374.25 ms. ($\sigma = 115$) and 314 ms ($\sigma = 101$) for the patients & normals respectively. 't' test revealed no significant differences between the 2 Mean R.T., indicating the patients were not slower than normals in simple motor reaction time.

The Mean R.T. at each stimulus duration in the choice R.T. paradigm for the 2 groups is given in the table. ANOVA (repeated measures) indicated inthe group effect was significant (F = 16.58, D df = 1, p. 01), but the stimulus durations (F = .03, df = 3) & the Group X stimulus durations

Table

The mean choice R.T. of the patients and normals at the four stimulus durations.

	Stimulus Durations			
	20 ms	40 ms	60 ms	80 ms
Patients	711 (135)	695 (113)	691 (131)	697 (123)
Normals	585 (84)	595 (84)	584 (85)	585 (98)

NOTE: Standard deviations are given in brackets

Mean error percentages of the 2 groups at the four stimulus durations

	Stimulus Durations			
	20 ms	40 ms	60 ms	80 ms
Patients	8.1%	4.2%	6.4%	4.6%
Normals	6.2%	4.2%	7.5%	6.5%

interaction (F = .04, df = 3) were insignificant. In view of the insignificant effect of stimulus duration, the mean R.T. of the 4 stimulus durations were combined and a composite mean R.T. was calculated for each subject. Again for each group an average of the composite mean R.T.'s over 8 subjects was calculated, which are 725 ms. ($\sigma = 124$) ms. and 571 ms ($\sigma = 87$) ms. respectively for the patients & normals. 't' test

between these 2 averages of the composite Mean R.T. showed them to be significantly different. ($t = 6.74$, $p < .01$). In fact all the patients have composite Mean R.T.'s above the average composite Mean R.T. of the normals, as against 3 normal subjects Mean Error percentage at each stimulus duration over the 2 exptl. sets in the table, indicate no significant differences between the 2 groups. Again the low error percentage indicates near maximum accuracy in both groups.

Discussion

The response programming stage of information procession appears to be deficient in PTS. The deficit is present only when complex programming is required. Lack of significant differences between patients and normals on simple R.T. indicates a normal speed of motor reaction in PTS.

As expected choice R.T. being complex is significantly longer than simple R.T. in both groups. (Woodworth & Schlosberg, 1954). In the choice R.T. Paradigm, the stimulus uncertainly and consequent information load was greater as probability of a stimulus was 1/4 (Lachman et al, 1979). But this increased information load has not adversely affected the patients, as the accuracy (error percentages) is equal in both groups. In the presence of this normal motor speed and normal accuracy, lengthening of the choice R.T. by 140 ms in patients to a deficit in response programming.

Speed accuracy trade off has not occured in either group, probably because the stimuli were clear enough to enable a consistent high occuracy performance. It is significant that patients with and without sedative medication do not differ in reaction time or accuracy. It is significant that Reaction time deficit are seen in half of the present sample (N - 4), even 2 years after injury, this is in contrast to the earlier findings of (Van Zomeren & Deelman, 1978) wherein the deficits had recoverd by 24 months. This prolonged persistence of deficits, in association with symptoms points to an organic basis for the syndrome. The earlier contention (Lishman, 1978), that prolonged post concussion symptoms are more likely to be psychogenic, require re-examination in the light of our findings.

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