

**LETTER TO THE EDITOR****AUDITORY EVENT RELATED POTENTIALS ( $P_{300}$ ) IN RUBBER FACTORY WORKERS – A PRELIMINARY STUDY**

Sir,

(Received on March 1, 1996)

The production of rubber products involves a mixture of complex chemicals (about 500) grouped into various functional categories (1). The workers are accordingly exposed to these chemicals besides noise exceeding 85 dB. The effect of this workplace environment on central nervous system particularly the sensory and cognitive functions has not been well documented. In this connection we conducted study on 40 rubber factory workers where we recorded stimulus related evoked potentials i.e. brain stem auditory, visual and somatosensory evoked potentials. In some of these subjects, we also conducted event related potentials ( $P_{300}$ ) studies which measure cognitive functions of the brain and found interesting results.

These workers belonging to raw material handling section of the factory, were brought to the Neurophysiology laboratory and asked to relax. SMP - 4100, Auditory Stimulator and MEB - 5200 Evoked Potential Recorder (NIHON KOHDEN, JAPAN) were used for this study.  $P_{300}$  was measured from vertex (CZ and PZ) in response to random application of two type of sound stimuli, presented binaurally through head phones, applied to subject's ears. Standard auditory 'odd ball' paradigm (2) was used in application of more frequent (non target) and the other less frequent (target) stimuli and asking the subject to respond by pressing a button whenever a target, infrequent stimulus was presented.

A total of 32 event responses so obtained were analysed by the evoked potential averaging method. Ag/AgCl disc electrodes, anchored with collodion were used for recording  $P_{300}$ . Active electrodes (-ve) were placed at CZ and PZ with reference electrodes at ear lobules ( $A_1 + A_2$ ). The ground electrode was placed at FZ. The input impedance was kept below 5K ohms. Alternating tone bursts with a starting condensation phase, of 10 msec rise/fall time, 100 msec duration (plateau time), intensity 70 dB, nHL and rate one every 2 sec were used as target stimuli. 80% of total (160) tones were 1 K HZ (frequent) and 20% were 2 K HZ (rare). Stimulus sequence was random. The signals were in phase at two ears. The MEB - 5200 settings were properly selected and evoked responses to the frequent and rare stimuli were filtered with a band pass 5-30 HZ (filter slope = 12 dB/octave) and averaged simultaneously for 32 responses. Data from two trials were obtained consequently and stored, analysed and averaged by the computer. The latency and amplitude of  $P_{300}$  for target stimulus (rare) was calculated.

Table I shows the values obtained for  $P_3$  latency and amplitude in the rubber factory workers. The mean value obtained was 344 msec (range 332 to 372). The figure shows morphology of  $P_3$  in a normal person and in the rubber factory worker.

The mean value of latency of  $P_3$  in case of rubber

TABLE I: Showing values of latency and amplitude of  $P_3$  in rubber factory workers.

Workers	Age (years)	Duration of exposure (months)	$P_{300}$ latency (msec)	$P_{300}$ amplitude ( $\mu$ v)
S	30	12	332	15.60
IS	35	156	372	10.90
AL	23	18	340	14.80
MT	25	14	332	9.37
Mean	28.25		344	12.66

TABLE II: Values (Mean  $\pm$  SD) of  $P_{300}$ - latency in normal subjects (<45 years of age) reported by various authors.

	Brown et al 1983	Polich and Starr 1984	Goodin et al 1978	Tandon 1990
$P_{300}$ Latency (msec)	$304 \pm 22.7$	$310 \pm 24.7$	$318 \pm 22.9$	$305 \pm 18.4$

factory workers is higher than the normal values reported by other workers (3, 4, 5) including our laboratory (6) as shown in Table II. This indicates that time needed in the central nervous system to analyze a stimulus to a level pertinent to elicit a behaviour response is delayed in a rubber factory worker which may be attributed to the work place environment consisting of multitude of chemicals and physical factors.

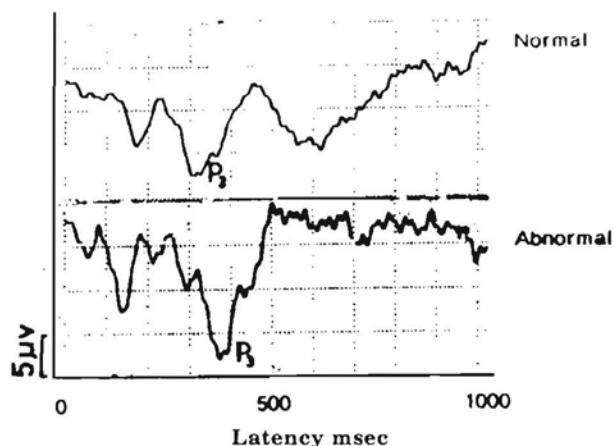


Fig. 1 : A normal and representative abnormal tracing of the Event Related Evoked Potential in a rubber factory worker indicating delayed latency of  $P_3$ .

All these workers belonged to raw material handling section of the factory, wherein exposure to chemical dust and vapors of solvents occur during handling of raw materials. However, it is very difficult to pin point the culprit chemical/physical factor accounting for prolongation of  $P_{300}$  latency. Other workers have reported prolongation of latency of  $P_{300}$  in steel smelting workers exposed to low level manganese (7), gun metal foundry workers exposed to lead (8) and to organic solvents (9). It needs to be mentioned that organic solvents are also used in the rubber factory and may perhaps be responsible for the changes in  $P_{300}$  latencies because of their affinity towards lipid rich tissue of brain.

Though, the sample size is small, the uniformity of results of all the 4 workers suggest changes in higher cognitive functions due to exposure to complex chemicals of rubber factory and delay in  $P_{300}$  component seems to increase with increasing duration of exposure (Table I). However, more elaborate studies are being conducted to elucidate this point and underlying mechanisms.

#### ACKNOWLEDGEMENTS

The laboratory help by Shri Bhupal Manjhi is acknowledged with thanks.

VIJAY KUMAR AND O. P. TANDON\*

Department of Physiology,  
University College of Medical Sciences,  
Shahdara, Delhi - 110 095

\*Corresponding Author

## REFERENCES

1. Holmberg B, Sjostrom B. A toxicology survey of chemicals used in the Swedish rubber industry Stockholm. *National Board of Occupational Safety and Health (Investigation on Report No. 9)*, 1977.
2. Duncan JC, Donchin E. On quantifying surprise : the variation of event related potentials with subjective probability. *Psychophysiology* 1977; **14** : 456-467.
3. Brown WS, Marsh JT, La Rue A. Exponential electrophysiological aging :  $P_3$  latency. *Electroencephalogr Clin Neurophysiol* 1983; **55** : 277-285.
4. Polich J, Starr A. Evoked potentials in aging. In : Albert ML (ed) : Clinical Neurology of Aging. Oxford University Press, New York, 1984 p 149.
5. Goodin DS, Squires KC, Henderson BH, Starr A. Age-related variation in evoked potentials to auditory stimuli in normal subjects. *Electroencephalogr Clin Neurophysiol* 1978; **44** : 447-458.
6. Tandon OP.  $P_3$  event-related evoked potential in young adults. *Indian J Physiol Pharmacol* 1990; **34(3)** : 191-194.
7. Wennberg A, Hagman M, Johansson L. Preclinical neurophysiological signs of parkinsonism in occupational manganese exposure. *Neurotoxicol* 1992; **13** : 271-274.
8. Araki S, Murata K, Yokoyama K, Uchido E. Auditory event-related potential ( $P_{300}$ ) in relation to peripheral nerve conduction in workers exposed to lead, zinc and copper and effects of lead on cognitive function and central nervous system. *Am J Int Med* 1992; **21** : 539-547.
9. Morrow L, Steinhauer SR, Hodgson MJ. Delay in  $P_{300}$  latency in patients with organic solvent exposure. *Arch Neurol* 1992; **49** : 315-320.