**Submit in: Proceedings of the XIth International Conference on Event-Related Potentials of the Brain, Okinawa, Japan, 25-30 June 1995.**

# MMN TO INTENSITY DEVIANTS IN SCHIZOPHRENICS WITH AND WITHOUT FORMAL THOUGHT DISORDERS.

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**Abstract**: Auditory event-related potentials (AERPs) were recorded at Fz, Cz, Pz, M1 and M2 from one group of 10 schizophrenics with major syndrome of formal thought disorders (+FTD) selected according to RDC, and DSM-III criteria compared to 10 schizophrenics without the FTD syndrome (-FTD) and to 10 controls. The three groups were matched for age, education, medication, hospitalization, and intelligence (abbreviated WAIS) score. Stimuli consisted of 80 dB SPL 1000Hz 50 ms tone pip standard (90%) and 60dB deviant (10%) presented binaurally, ISI ranging from 550 to 650 msec. To control to attentional direction subjects have to read a novel and to summarize the script at the end of the session. An exclusion criterion of 80% accuracy was applied for screening subjects. Results show no significant differences between groups for MMN amplitude or latency at any electrode site. A significant electrode effect was found indicating that the amplitude was greater at Fz and Cz than Pz , M1 and M2. In conclusion these data did not support automatic attentive deficit in schizophrenics when attentional processes are closely assessed.

**Key words**: Attention, Evoked potential, Auditory, Psychosis

## INTRODUCTION

When an infrequent stimulus physically deviates from an ongoing train of "standard" stimuli, a mismatch negativity (MMN) is elicited. The MMN has been can be evoked by a number of different deviant stimuli although tonal pitch [], intensity [], and duration [] mismatches have been most commonly used. It was originally thought that the MMN was

unaffected by the subject's level of attention. It is now generally accepted that attention can modulate at least the intensity-elicited MMN, the pitch-elicited MMN being less affected []. The MMN consists of at least two sub-components, an early fronto-central negativity peaking from 100-250 ms and a later more central maximum negativity peaking between 250 and 400 ms. The early component is thought to reflect detection of the deviant (although not necessarily conscious detection) while the later component is thought to reflect an orientation or a switch toward the deviant.

Schizophrenic formal thought disorders (FTD) involve problems with derailment of thinking, loose associations, overinclusion, deficits of abstraction, these are often defined as concreteness, and may be manifested verbally in the structuring of words (such as neologisms) and in the concreteness of word associations (such as in word salads). Many authors considered them to be primary schizophrenia-specific symptoms, in contrast to content thought disorders (manifested in the bizarreness or low probability of word content) which are reliably shown to be secondary to psychotic processes and possibly to anxiety[].[6-9] In previous studies [], we have showed that schizophrenic patients displaying formal thought disorder (+FTD) are characterized by deficient attentional modulations of frontal negativities, by pervasive attentional deficits of the response-set type with slow processing (hypoarousal). Also they appear to be unable to maintain attention to a relevant stimulus channel. On the other hand, chizophrenic patients displaying an absence of formal thought disorder (-FTD) appear to present AERP indices of intrusion (large frontal N1 and P3 to ignored channel), cognitive perseveration (large late post-response neagtivity) and distraction related to input dysfunction and hyperarousal.

The MMN, particularly the later component, should differentiate these patient sub-types. Shelley et al [] reported that the MMN folllowing duration deviants was significantly attenuated in schizophrenic patients. He did not however exammine the sub-components of the MMN. Moreover, he did not sub-type the schizophrenic patients. The present

study will record intensity MMNs in patients displaying the presence or absence of formal thought disorder. The intensity MMN is much more sensitive to the types of attentional fluctuation that are often observed in schizophrenicss than the duration MMN used by Shelley et al.

## METHODS

SUBJECTS:

In a previous study [] we have showed that (+FTD) schizophrenics presented an attenuation of MMN amplitude compared to -FTD and control group in a dichotic listening task. However occasional attentional shift to the ignored channel could not be controlled for by this paradigm. In this study using the same subject sample, we have compared one group of 10 schizophrenics with major syndrome of formal thought disorders (+FTD) selected according to RDC, and DSM-III criteria to 10 schizophrenics without the FTD syndrome (-FTD) and to 10 controls.

The 3 groups were matched for age, education, medication, hospitalization, and intelligence (abbreviated WAIS)score.

EEG RECORDING:

The EEG was recorded from Fz, Cz and Pz and referenced to the tip of the nose. An additional electrode was placed on the right mastoid. A "true" MMN should reverse in polarity at this site [](Alho et al., 19xx). A vertical EOG was recorded from the supra- and infra-orbital ridges of the left eye. A horizontal EOG was recorded from the outer canthi of each eye. The high frequency filter was set at 35 Hz while the time constant was 1 sec.

A commercial evoked potential system (InstEP Systems) was used for the digitization of the physiological signals, control of stimulus presentation and analyses of the data. The EEG and EOG were sampled continuously at a rate of 250 Hz and stored on hard disk. The EEG was subsequently corrected for eye movements and blinks using an algorithm operating in the frequency domain [] (Woestenburg, 1983). The continuous

EEG and EOG signals were then sorted into discrete 500 ms epoch trials, beginning 50 ms before stimulus onset.

Stimuli and Procedure

Standard 60 dB SPL 1000 Hz tone pips having a total duration of 55 ms and a rise-and-fall time of 5 ms were presented binaurally through calibrated headphones. At random, on 10% of the trials, a deviant was presented. The deviant stimulus was identical to the standard except that its intensity was increased to 70 dB SPL. A total of 1000 stimuli were presented in a block. A random inter-stimulus interval was employed, ranging from 550 to 650 ms (mean = 600 ms). In order to maintain constancy of arousal and attention, the subject was asked to read a book throughout the session. Attention to the reading task was subsequently verified by use of a questionnaire. Performance had to exceed 80% for the evoked potential data to be considered to be valid. No patients' or subjects' data were however rejected for this reason.

The MMN was quantified using both a peak detection method and the averaging of data points. A early peak was detected between 100 and 250 msec and a latter between 250 and 450 msec at Cz (where the overall MMN tended to be largest). The amplitude MMN was then measured at this latency at all other electrode sites. This peak-detection method is similar to that employed by Shelley et al. The MMN was also measured by averaging all data points in consecutive 50 ms intervals (i.e., 1-50 ms, 51-100 ms, 101-150 ms, 151-200 ms, 201-250 ms, 251-300 ms, 301-350 ms, 351-400 ms and 401-450 ms). This method is often used in the literature [] and has the advantage that sub-components of the MMN can be captured.

## RESULTS

An identifiable MMN (greater than 0.5 uV at Cz and inverting in polarity at the mastoid) could be identified in 9 controls, in 8 of the -FTD patients and in 8 of the +FTD patients. Tables 1 and 2 present respectively early and late MMN mean amplitude and latency for each electrode sites (M1,

Fz, Cz, Pz, M2) and for each group (Controls, -FTD, +FTD). The grand averages are presented in Figure 1. The early fronto-central MMN (indicated by a closed triangle), peaking at 161 ms tended to be larger in controls than in the patients. A MANOVA comparing the three groups and electrode site was however not significant for either peak amplitude or latency. More liberal one-way t-tests were then applied to the data. Again, no significant differences were found ($t < 1$ in all cases). may be observed, the MMN consisted of two sub-components. An earl
Since their attention is easily diverted to irrelevant stimuli, it would be expect

Table 1

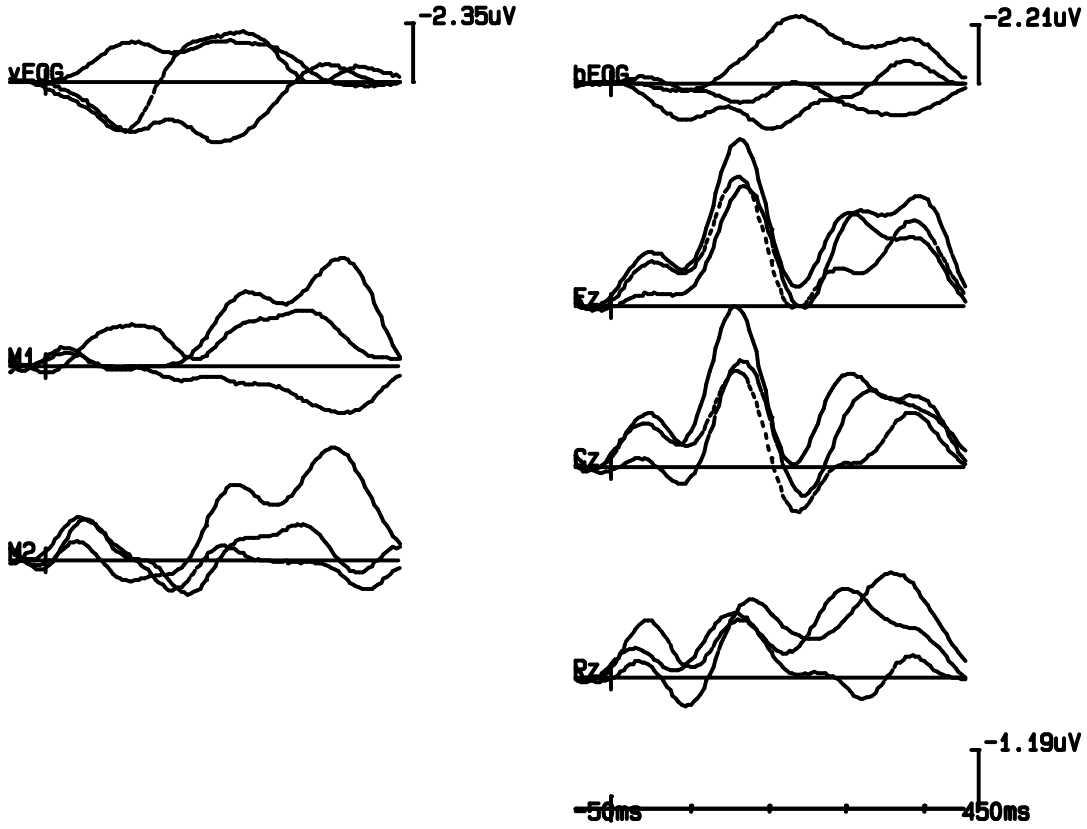
Early MMN mean amplitude (uV) and latence (msec).

| | M1 | Fz | Cz | Pz | M2 | Latence |
|---|---|---|---|---|---|---|
| Controls | -0.6 | -3.3 | -3.4 | -1.5 | 0.4 | 162.7 |
| -FTD | -0.1 | -2.4 | -2.3 | -1.5 | 0.1 | 165.3 |
| +FTD | +0.1 | -2.7 | -2.2 | -1.4 | 0.3 | 161.5 |

Table 2

Late MMN mean amplitude (uV) and latence (msec).

| | M1 | Fz | Cz | Pz | M2 | Latence |
|---|---|---|---|---|---|---|
| Controls | -1.1 | -2.2 | -2.3 | -1.8 | -0.3 | 322.4 |
| -FTD | -1.4 | -1.9 | -2.3 | -1.9 | -1.4 | 355.8 |
| +FTD | +0.8 | -1.7 | -1.3 | -0.9 | +0.2 | 355.3 |


-2.35uV
vEOG
M1
M2
-2.21uV
hEOG
Fz
Cz
Pz
-1.19uV
-50ms
450ms