EYE MOVEMENTS AND SCHIZOPHRENIA

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SUMMARY

Smooth pursuit eye movements (SPEM) has been reported to be abnormal in schizophrenic patients. 30 schizophrenic patients and 15 normal subjects were examined for the quality of their smooth pursuit performance. 73.33% of the schizophrenics and 40% of the normal subjects had 'impaired' pursuit performance. The significance of the findings has been discussed.

Smooth pursuit eye movements (SPEM) has been found to be impaired among schizophrenics and their first degree relatives (Holzman, 1985) and this abnormality has been reported consistently by various workers (Holzman, 1985; Yee et al., 1987; Ross et al., 1988).

SPEM dysfunction among schizophrenics has also been considered a genetic trait marker of schizophrenia. Among various biochemical and psychophysiological charecteristics studied as the genetic marker of schizophrenia the status of SPEM dysfunction as a genetic marker has been most consistently supported by studies (Erlenmeyer-Kimling and Carnblatt, 1987; Holzman, 1985).

The present study is the part of a larger study designed to explore the trait marker status of SPEM dysfunction its specificity to schizophrenia and its relationship with other biochemical and psychophysiological correlates of schizophrenia in particular and psychosis in general.

MATERIAL AND METHODS

Subjects

The study included 30 schizophrenics and 15 normal controls. Consecutive, schizo-

phrenic patients, attending the psychiatry OPD or admitted as in-patients at the National Institute of Mental Health and Neurosciences, Bangalore and who fulfilled the research criteria were selected for the purpose of this study. The diagnosis of schizophrenia was made according to the DSM-III criteria (APA, 1980).

The normal group was selected from the postgraduate and doctoral students as well as from hospital employees of the Institute.

They were interviewed after their informed consent. None of the controls had any psychotic symptoms, any family history of psychosis, alcoholism and suicide or a history of any drug addiction, alcoholism, personality disorder, epilepsy or significant head injury.

It was ensured that all the subjects had an adequate nights sleep prior to the testing. None of the subjects had participated in any similar eye-movement experiment in the past.

All the 45 subjects had not consumed any minor tranquillizers or alcohol within 15 days prior to the time of testing. No subject had ever consumed lithium.

All subjects were free from nystagmus, strabismus or any other neurological impairment including drug induced extrapyramidal syndromes. Subjects with defective visual

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acuity wore their glasses during testing. The subjects were of atleast average intelligence on clinical assessment (no formal IQ testing was done).

Target

A Nihon-Kohden (Japan) Nystagmo-stimulator consisting of light emitting diodes (LEDS) was used as a visual target for sinusoidal tracking. The target was placed in front of a patternless white back ground. The target moved 10° to the left and 10° the right of the visual angle from the center at a frequency of 0.4 HZ in a sinusoidal pattern.

Procedure

After the selection of the subjects, the severity of psychosis was rated on the Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1962). The subjects were then introduced to the instruments by requiring them to track the target for few minutes both in sine wave and square wave form.

Ag-Agcl electrodes were applied at the both outer canthi and the centre of forehead (ground electrode).

Electro-oculographic technique was used to record the eye movements with the help of an EEG machine and a D-C electro-oculographic amplifier (Oster and Stren, 1980). The subjects were seated 50 cm in front of the target, and their head was fixed with the help of a chin rest. They were required to follow the target light carefully without moving their heads. Subjects were alerted and realerted to follow the target carefully at the completion of every 10 cycles. A total of 30 cycles of eye movements were recorded for each individual.

EOG—records were numbered serially without assigning any other identification data for the purpose of blind rating.

Ratings of EOG

Benitez's 4-point rating scale (Benitez, 1970) was used to rate the quality of smooth-pursuit movement.

Initially, a set of fifty records obtained from the subjects not included in this study were rated by the two raters (RS and SC) independently. The raters had discussed the rating scale between themselves before the actual rating. The inter-rater reliability of the rating scale was significant (Cohen's $K = 0.5749$).

Using Holzman et al's criteria the records were also categorized as normal or abnormal (Holzman et al., 1973, 1974). The inter-rater reliability for it was also significant (Cohen's $K = 0.9124$). The final ratings were arrived by consensus between the two raters. The EOG ratings were rated separately for the pre alert, alert and realert states. Only the best tracings from these three conditions were included in the analysis.

The data was analysed using the Chi-square test, 't' test and the analysis of variance (ANOVA).

RESULT

Sex and Age distribution

Both the groups were comparable on these demographic variables (Table 1).

TABLE 1. *Age and Sex distribution of subjects*

	Schizophrenic patients (N=30)	Normal controls (N=15)
Sex		
Male	21	8
Female	9	7
$X^2 = 1.21$, d.f. = 1, N.S.		
Age (in yrs.)		
Mean ± s.d.	30.3 ± 5.1	31.3 ± 8.5
Range	20—38	23—57
t = 0.48, d.f. = 43, N.S.		

Prevalence of smooth pursuit dysfunction

(Table 2). The prevalence of 'abnormal' pursuit eye movements among schizophre-

TABLE 2. *SPEM dysfunction : prevalence rate and mean ratings*

	Schizophrenics (N=38)	Normal controls (N=25)
No. of abnormal records	22	6
Prevalence of SPEM dysfunction	73.33%	40%
Mean rating score	2.93±0.68	2.26±0.70

nics was 73.33% while only 40% of normal controls had 'abnormal' pursuit eye movements. The groups differed significantly from each other ($x^2 = 4.73$, d.f. = 1, p < 0.05).

On comparison of their mean EOG-ratings according to the Benitez's scale, the two groups were significantly different (t = 3.09, d.f. = 43, p < 0.005). Schizophrenic patients in general performed poorly on pursuit task.

ILLNESS VARIABLES : (Table 3)
(a) Duration of illness
Analysis of variance (ANOVA) was used to find out the relation of duration of illness to the severity of pursuit dysfunction as rated on the 4 point scale. The duration of illness was not related to the severity of pursuit dysfunction.

(b) BPRS score
Three schizophrenics could not be rated on BPRS. Out of 27 schizophrenics subjects, 7 subjects had obtained an EOG rating of 2, 15 subjects had obtained on EOG rating of 3 while 5 subjects had an EOG rating of 4. None of the schizophrenic subjects received

a rating of one. The severity of illness i.e. the BPRS score was not significantly related to the severity of pursuit impairment on statistical analysis using 't' test.

(c) Score on the withdrawal-retardation higher order factor of BPRS
The withdrawal-retardation higher order factor is the sum of the scores on three items of BPRS i.e. emotional withdrawal, motor retardation and blunted affect. There was no relation between this score and the severity of pursuit impairment (F = 1.074, d.f. = 2,24, N.S.).

DISCUSSION
The study reports a higher prevalence of smooth pursuit eye movement impairment among schizophrenics as compared to normal population (73.33% Vs. 40%). This is in consonant with the earlier reported prevalence of SPEM dysfunction among schizophrenics which varies from 52% to 86% (Holzman et al., 1974).

Similarly, in agreement with the earlier studies, the mean ratings of all the schizophrenics differed significantly from the normal controls (Shagaas et al., 1974; Brezinova and Kendell, 1977; Pass et al., 1978; Salzman et al., 1978 and Iacono et al., 1982).

These findings strengthen the reported association between schizophrenia and impaired SPEM.

However, 40% of normal subjects in this study had poor eye tracking, while only 8% of the controls were reported to have similar

TABLE 3. *Illness variables and SPEM dysfunction*

	Duration of illness in months	BPRS score	Scores on the withdrawal retardation higher order factor of BPRS
No.	30	27	27
Mean ±SD	78.23±52.11	14.77±6.76	4.74±3.33
Range	8 – 180	5 – 25	0 – 11
Variable vs. EOG Rating	F = 1.03 d.f.=2,27,NS.	t=0.55, N.S.	F=1.0744, d.f.=2,24,N.S

abnormality in Holzman et al.'s (1974) study. Holzman and colleagues selected their control subjects after screening them by the Minnesota Multphasic Personality Inventory (MMPI). Subjects who were normal otherwise, but who scored high on certain scales (scales 2, 7 and 8) of MMPI were rejected. Such a criteria for normality was based on assumption that the elevation of scores on these scales of MMPI indicates a predisposition to schizophrenia. We feel that the elevation of scores on certain scales of MMPI may not be related to predisposition to schizophrenia. At the same time, the use of the MMPI to define normality may systematically bias the sample and the individuals with certain traits which do not correlate with SPEM impairment may be systematically recruited in the study. The subjects in the present study were more representative of a normal population. Even other studies where normal subjects were not recruited based upon their performance on a psychological test have demonstrated higher prevalence of SPEM dysfunction (Iacono and Lykken, 1979; Yee et al., 1987, Pivik, 1979).

Yet another, explanation for such a finding may be the fact that microsaccades are normaly found during fixation and pursuit eye movements and are supposed to be essential for the vision (Eckmiller, 1987; Stark, 1983).

It is proposed that it would be advisable to classify eye movements into type 'A' and type 'B' rather them normal and deviant respectively.

But, the definitely higher prevalance of type 'B' SPEM among schizophrenics calls for further studies regarding the nature of the relationship of the pursuit impairment to the illness.

Further exploratio.i of the state marker-trait marker of schizophrenia status of SPEM impairment, association of various hypothesized biochemical abnormalities of schizo-phrenic to SPEM impairment and the comparison of the information processing styles of normals, schizophrenics and the persons with SPEM impairment should be of interest.

Acknowledgement

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APPENDIX —I

Symptom check-list & PPQ

N.B.: The following symptoms are to be scored as 'present' only if they have been present for a period of at least 3 months.

'Does the patient have any of the following symptoms ?'

* *1. Generalised aches and pains
* *2. Headache
* *3. Pain in the chest
* *4. Shortness of breath
* *5. Unduly tired, fatigued
* *6. Giddiness, dizziness
* *7. Feeling 'weak'
* *8. Unable to work as before
* *9. Sleeplessness
* *10. Appetite loss
* *11. Forgetfulness

*—These 7 items formed the Primary care Psychiatric Questionnaire (PPQ).