NON-INVASIVE DETECTION OF PSYCHOTROPIC DRUG INGESTION

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INTRODUCTION

For several years it has been noted that electronystagmograph (ENG) testing has been influenced by certain drugs (1,2). Westerman and Gilbert reported a non-invasive method of drug identification using an electronystagmograph (ENG) in 1981 and further elaborated on this method of drug evoked potential analysis in 1984 (3,4).

Wave forms were obtained from subjects who were administered various psychotropic drugs or who had various otolaryngological or neurological difficulties (N=1503). These wave forms were visually analyzed and the consistent signals produced by each drug were categorized and learned by experts. Results indicated that a specific wave form was produced by each family of psychoactive drug, and the signals produced in the wave form were consistent for each drug between subjects. It was also found that these signals were repeatable in the same subject. The intensity of the signals appeared to be dose and time related.

It was possible to specifically diagnose the psychotropic drug families of hallucinogen, cocaine, tranquilizer, barbiturate, opiates, amphetamines, alcohol, and marijuana.

None of the subjects with pathology examined in this preliminary study produced a wave form that was compatible with the drug evoked potentials identified. False positive rate was <1%.
Wave forms from 902 of these subjects were diagnosed under blind conditions by experts. Diagnostic ability was in the high ninetieth percentile for drugs tested at these dosage levels.

DRUG ACTIONS

Numerous studies have been presented in the literature regarding the effects of alcohol on the ENG wave form (5).

Certain psychotropic drugs act directly on the reticular formation, either by a depressant action such as the barbiturates and alcohol, or by an excitant action, e.g. amphetamine, resulting in an alteration in the production of nystagmus. (6)

Drugs that selectively alter CNS function may cause depression or excitation, or may produce both effects simultaneously on different systems. Although a specific CNS function may be highly affected by a drug, usually several functions are affected to varying degrees. (7).

These observations indicate that psychotropic drugs either directly or indirectly affect the regions of the brain which influence the production of the wave form obtained by a standard electronystagmograph.

MATERIAL AND METHODS

In order to make use of this technology on a wider basis, a plan was developed to reduce the components of the visual identification process to mathematical algorithms.

In Phase I, data was collected from 245 subjects (502 trials). Data was then evaluated by experts in blind tests. Experts were asked to identify features in the wave forms that influenced their diagnosis.

All subjects were at least 21 years of age and were selected
randomly from the general population.

Drug Treatments

**Alcohol.** Subjects were permitted to drink the alcoholic beverage of their choice at their own individual rates. They were encouraged to drink until breathalyzer scores were at least .10% W/V, but not more than .25% W/V.

**Cocaine.** 0.2 (2ml of 10% solution) to 0.5 gm (5ml of 10% solution), was applied intranasally on two cotton tampons, one in each nostril, and held in place for 20 minutes.

**Morphine.** 15 mgs. in tablet form were administered to subjects weighing between 120 to 150 lbs. 22 1/2 mgs. in tablet form were administered to subjects weighing over 150 lbs.

**Marijuana.** One marijuana cigarette containing 1.29% Delta-9 THC was smoked by each subject in the marijuana arm of the study.

**Testing procedure**

The Veritas 100 Analyzer was developed to collect data in digital format. Silver/silver chloride electrodes were placed bitemporally. A third electrode, which served as a ground, was placed in the center of the forehead.

The subject was calibrated and wave forms used in evaluation were then recorded for 35 seconds in four positions.

**Expert Performance**

Experts Westerman and Gilbert were independently blind tested on 502 sets of waveforms, selected at random, in groups of 20 to 40 at a time. These included 157 baselines, 64 controls, 40 alcohol, 58 cocaine, 61 marijuana, and 122 opiates. The experts had approximately 20 and 6 years experience respectively in
evaluating ENG wave forms.

RESULTS

Individual false positive rates were under 1.0% for all drugs combined, cross-diagnoses between drugs were 0.0%. False negative rates by subject were as follows: 14% alcohol, 7% cocaine, 13% marijuana, and 0% opiate.

CONCLUSIONS

Based on blind testing of two experts, it has been demonstrated that drugs ingested by a human subject can be accurately identified by visual interpretation of electronystagmograph wave forms.

It is concluded that the methodology described above would meet the needs of a larger population if it could be automated. A companion paper reports results of the development and application of diagnostic algorithms to wave forms.

REFERENCES

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