Postgraduate Medicine

ISSN: 0032-5481 (Print) 1941-9260 (Online) Journal homepage: http://www.tandfonline.com/loi/ipgm20

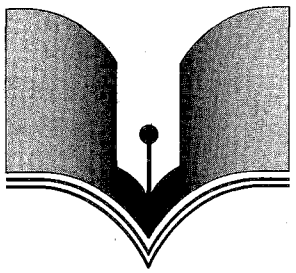
The rapid eye test to detect drug abuse

Forest Tennant MD, DrPH

To cite this article: Forest Tennant MD, DrPH (1988) The rapid eye test to detect drug abuse, Postgraduate Medicine, 84:1, 108-114, DOI: 10.1080/00325481.1988.11700339

To link to this article: http://dx.doi.org/10.1080/00325481.1988.11700339

Published online: 17 May 2016.



A PGM symposium
Is your patient abusing drugs?
First of three articles

Forest Tennant, MD, DrPH

The rapid eye test to detect drug abuse

Preview questions

What are the primary eye signs of drug abuse?

In what ways is the rapid eye test preferable to urine testing?

Can the test be used by nonmedical personnel?

The eye is the easiest part of the body to examine for drug influence. It is located next to the brain and is essentially part of the CNS. Any drug that affects the CNS almost always has an influence on the eye. Because proper eye function requires precise action of very small nerves and muscles, even small doses of some drugs disturb normal physiologic processes and produce eye signs.[1-5]

Numerous studies and clinical reports document the principal effects of commonly abused drugs on the eye.[6-11] Most of these effects can be easily detected by a simple, one-minute rapid eye test that I have formalized to assist in the clinical detection and management of patients who abuse drugs.

Background

Pupil size and reaction have been used to evaluate the effects of opioid drugs since 1935.[12-15] Various eye signs were reported in drug abusers in the 1940s, and testing for nystagmus was used to detect alcohol intoxication in the 1950s.[16,17]

I started using the rapid eye test in the early 1970s to assist in the clinical treatment of drug-dependent patients. The test proved invaluable in determining the safety of administering a withdrawal medication to a patient entering treatment. For example, it is dangerous to give methadone (Dolophine) to a heroin addict whose pupils are constricted to less than 3 mm in diameter.[18-20] A significant amount of heroin is probably still in the plasma, and adding methadone to the heroin may result in an overdose and possibly coma or even death.[19]

During the epidemic of barbiturate abuse in the early 1970s, dependent persons often sought medical treatment. If they had nystagmus and pupils that reacted poorly to light, they were considered to have too much barbiturate in their system to be given withdrawal medication.[2] Also during the 1970s, amphetamine abuse was common and was often detected by the presence of dilated pupils that did not react to light.

continued

Illustration: Sandra Filippucci © 1988

The rapid eye test is gaining popularity because of the high cost of blood and urine testing and the controversy over privacy rights.

Table 1. Components of rapid eye test for drug abuse

Component	Method	Common findings
General observation	Observe eye in room light	Redness of sclera Ptosis Retracted upper lid (walleye or bug-eye); white sclera visible above iris, causing blank stare or exophthalmic appearance Glazing (film over cornea) Excessive tearing of one or both eyes Swelling of eyelids
Pupil size	In room light, determine whether pupil diameter is wider or narrower than one side of iris, less than 3.0 mm, or greater than 6.5 mm[25,26]	Dilation Constriction
Pupil reaction	Flick light into each pupil	Slow, sluggish, or absent response
Nystagmus	Hold your finger in a vertical position; tell subject to follow your finger as you move it to the side (horizontal), in a circle (rotation), and up and down (vertical)	Failure to hold gaze Jerkiness of movements
Convergence	Hold your finger in a vertical position about 1 ft away from subject's nose; tell subject to (1) follow your finger as you move it to about 1 in. in front of his or her nose and (2) hold this position for 5 sec	Inability to track or hold the cross-eyed position
Corneal reflex	Touch cornea with strand of cotton or thread	Decreased rate of blinking

Early in the 1980s, phencyclidine (PCP), cocaine, and high-potency marijuana became common drugs of abuse.[21-23] Dependent persons who sought medical treatment had to be tested for signs of drug influence so they could be given withdrawal medication safely.[21,22] PCP, cocaine, and marijuana, like other drugs of abuse, produce typical eye signs that permit a clinical diagnosis of drug influence.[1,4,11,23]

Forest Tennant, MD, DrPH
Dr Tennant is associate professor, University of California, Los Angeles, UCLA School of Public Health, UCLA Center for Health Sciences. He serves as drug advisor to the National Football League, Los Angeles Dodgers, and National Association of Stock Car Auto Racing.

Advantages

The ability of the rapid eye test to detect drug influence helps in monitoring the effectiveness of treatment. For example, the cocaine-dependent person who enters treatment with a dilated, nonreactive pupil and a few days later has a normal-sized, reactive pupil demonstrates to the clinician that he or

The rapid eye test suggests drug use when two of five primary eye signs are present.

she is probably no longer using cocaine.[22]

Nurses and, after special training, even nonmedical personnel can administer the rapid eye test. Because of its simplicity and accuracy, the test has been used in nonclinical settings over the past decade. Law enforcement personnel, particularly narcotics officers and highway patrol officers in California and Nevada, routinely administer it to persons suspected of drug use.[23,24] If eye signs are present, a blood or urine test is done to confirm the use of drugs. Recently, the rapid eye test has been used to detect drug influence in employees and athletes. Often, the test is done as part of a more comprehensive "fitness-for-duty" examination to determine whether an athlete or an employee with a high-risk job is competent to perform or work.

Because of the high cost of urine and blood testing and the controversy over privacy rights, the rapid eye test is quickly gaining popularity. The test is inexpensive and noninvasive and does not require exposure of private body parts. In addition to screening clinical patients, physicians may be called on by commercial, athletic, or educational institutions for consultation or to confirm the results of a test conducted by a nonmedical person.

Test procedure

The rapid eye test should be performed in a quiet, private setting so as not to distract the subject. It can be done in ordinary room light with the subject standing or sitting erect with feet together.

The test consists of five parts: (1) general observation, (2) measurement of pupil size, (3) observation of pupil reaction to light, (4) testing for nystagmus, and (5) testing for convergence (table 1). The corneal reflex test also may be helpful. Most drugs of abuse paralyze the cornea, and the user does little or no blinking when a piece of cotton or thread is placed on the cornea.

Common eye signs

Each of the most frequently abused drugs produces typical eye signs (table 2). In nontolerant persons who ingest the usual street doses, cocaine and amphetamines dilate the pupil (figure 1) and reduce its ability to respond to a light challenge. Heroin routinely constricts the pupil (figure 2). Nonconvergence and a slow-reacting pupil are typical with

continued

Table 2. Common eye signs with various drugs of abuse

Marijuana	
Normal-sized pupil	
Slow or no reaction of pupil to light	
Nonconvergence	
Redness of sclera	
Glazing of cornea	
Horizontal nystagmus	
Swollen eyelids	
Watering	
Heroin	
Constricted pupil	
Nonreactive pupil	
Ptosis	
Glazing of cornea	
Decreased corneal reflex	
Swollen eyelids	
Alcohol/benzodiazepines	
Normal-sized pupil	
Slow or no reaction of pupil to light	
Nystagmus	
Redness of sclera	
Glazing of cornea	
Nonconvergence	
Cocaine/amphetamine	
Dilated pupil	
Slow or no reaction of pupil to light	
Decreased corneal reflex	
Phencyclidine (PCP)	
Normal-sized pupil	
Slow or no reaction of pupil to light	
Nystagmus	
Retracted upper eyelid (walleye or bug-eye)	
Decreased corneal reflex	
Swollen eyelids	

The most commonly abused prescription drugs are opioids and benzodiazepines.

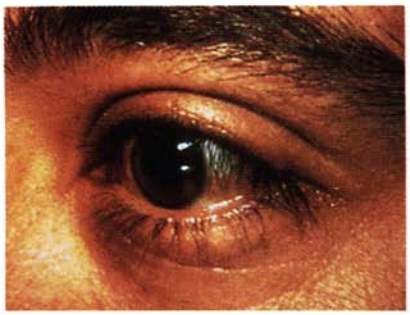


Figure 1. Dilated pupil with acute cocaine-amphetamine influence.

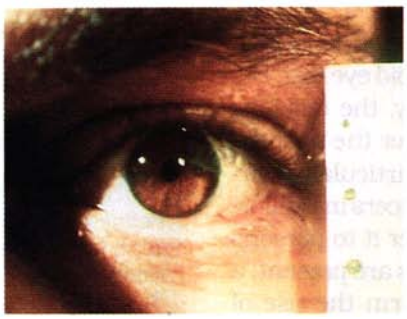


Figure 2. Constricted pupil (about 1.5 mm) in heroin user.

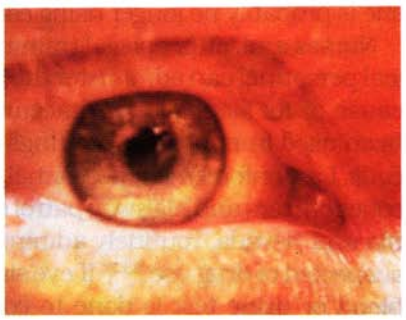


Figure 3. Reddish, glazed eye in person under acute marijuana influence. Pupil is of normal size; eyelid is slightly swollen.

Figure 4. Retracted upper eyelid causing blank stare in phencyclidine (PCP) user.

Figure 5. Constricted pupil, reddish sclera, and watering of eye in person under acute influence of marijuana and heroin.

Figure 6. Droopy eyelid, constricted pupil, and reddish sclera in person under acute influence of marijuana and PCP.

marijuana influence; the pupil is of normal size and the eye is reddish and glazed (figure 3). The blank stare of a PCP user is shown in figure 4.

Very high doses of a drug may result in unusual eye signs. For example, very high doses of cocaine may constrict, rather than dilate, the pupil.[22] When several drugs, including alcohol, are used within a 24-hour period, the effects on the eye also may not follow usual patterns. In these situations, a counteractive or potentiating effect may be noted. Alcohol is the most common potentiator, often enhancing the eye effects of heroin, marijuana, PCP, and most prescription sedatives.

A common counteractive effect is observed when cocaine and heroin are administered simultaneously. The pupil neither constricts nor dilates but instead remains normal in size. It does react poorly to light, however, and the corneal reflex is decreased. When alcohol is consumed with cocaine, the pupil may dilate, and nystagmus and nonconvergence often are noted. Cocaine and marijuana are frequently used together and commonly cause pupil dilation and nonconvergence. If multiple sedative drugs are used, particularly with alcohol, the pupil may constrict and be nonreactive. Figures 5 and 6 show eye signs in users of more than one drug.

The rapid eye test can be used to determine whether an employee or athlete is "fit for duty."

Criteria for a positive test

The rapid eye test is considered suggestive of drug influence only if two or more of the five primary eye signs (ptosis, abnormal pupil size, nonreactive pupil, nystagmus, nonconvergence) are present. The presence of only one sign (with the possible exception of a pupil that is nonreactive to light) usually is not considered indicative of drug influence.

Because of genetic traits, 1% to 2% of the general population shows nystagmus or nonconvergence,[27] and others may have congenital constriction or dilation of the pupil. Psychological factors may also influence eye signs but rarely cause the simultaneous presence of two primary eye signs.[27,28]

Clinical studies indicate that the rapid eye test is quite reliable, and false-positive results are few.[24,29] Clinical conditions (other than drug influence and congenital defects) that produce a positive test include neuropathies, tertiary syphilis, tumors, and generalized neurologic conditions such as multiple sclerosis.[30-32]

A negative test does not exclude the possibility that the person has used drugs in the recent past. An abusable drug produces eye signs for only a few hours after ingestion. Also, a very low dose of a drug may not be potent enough to produce eye signs but may be detectable in urine. Chronic users who are tolerant to a drug's effect may not show eye signs.[8,13,21,22]

Confirmation by urine testing

A positive rapid eye test should be considered highly suggestive of drug influence.[25,26] In medicolegal terms, a positive test can justify "reasonable suspicion" of drug use, because few medical conditions cause results of two of the five primary tests to be abnormal. The cause of a positive test must be medically explained by body fluid analysis to confirm drug use.

Urine needs to be analyzed for drugs that are most commonly abused today, that is, marijuana, cocaine, PCP, amphetamine, opioids, alcohol, and benzodiazepines. Instruments must be sensitive enough to detect minute amounts of each drug.

The most commonly abused prescription drugs are opioids and benzodiazepines. Opioids include codeine, morphine, hydrocodone (eg, Hycodan), oxycodone (eg, Percodan), opium (eg, paregoric), meperidine (Demerol), and hydromorphone (Dilaudid). Benzodiazepines include diazepam (Valium), chlordiazepoxide (Librium), alprazolam (Xanax), flurazepam (Dalmane), lorazepam (Ativan), and triazolam (Halcion). The most commonly abused over-the-counter drugs that may produce eye signs (particularly when consumed in higher than recommended doses), are phenylpropanolamine and ephedrine.

A urine test does not always detect drugs that have been taken. Eye signs usually occur within 15 minutes after sniffing, inhaling, or injecting a drug, but the drug may not reach the urine for one to two hours.[33,34] During this interim, the rapid eye test is positive but no drugs are detected in the urine.

Clinical uses

The rapid eye test can be used as a screening device during physical examinations for employment, motor vehicle licenses, or participation in sports. Clinical patients, particularly adolescents and those with psychiatric symptoms, should be tested routinely because they are at high risk for drug use.

Of special interest today is the use of the rapid eye test as an alternative to urine testing in schools and in athletic and business areas. Many organizations are instituting the test because it is far less expensive and is perceived as less intrusive on privacy than urine testing. Perhaps more important, the rapid eye test detects the actual influence of a drug on the body, while urinalysis only demonstrates the presence or absence of a drug.

Because the eye is the most reliable indicator of drug influence, the rapid eye test can be used to determine whether a person is "fit for duty" in safety-related occupations or sports. The eye may demonstrate abnormal signs when other physiologic evidence of drug use is not detectable. Nevertheless, other neurologic functions (balance, attention span,

continued

mental capacity) should be assessed for evidence of drug influence, especially when additional information on the severity of a drug's effect is needed to determine whether a person can safely drive, attend school, play sports, or work. In addition, blood pressure, pulse and respiratory rates, temperature, and reflexes can all be altered by use of drugs.

Summary

Because the current epidemic of drug abuse has touched all levels of society, the primary care physician is increasingly called on to identify, monitor, and treat persons with drug abuse problems. All of the major drugs of abuse, including cocaine, marijuana, amphetamine, phencyclidine, heroin, and alcohol, may produce typical eye signs that can be easily detected by a rapid eye test. These signs include ptosis, abnormal pupil size, nonreactivity of the pupil to a light challenge, nystagmus, and nonconvergence.

When eye signs are detected, drug use should be confirmed by analysis of body fluids. The rapid eye test is suitable for routine use when screening adolescents, athletes, and employees with jobs where safety is essential. PGM

Address for correspondence: Forest Tennant, MD, DrPH, Community Health Projects Medical Group, Research and Education Division, 336½ So Glendora Ave, West Covina, CA 91790.

CME Credit Quiz begins on page 117.

References

1. Abramowicz M. Treatment of acute drug abuse reactions. Med Lett Drugs Ther 1987;29(Sep 11):83-6
2. Bener MB, O'Brien FH. The influence of barbiturates on various forms of nystagmus. Am J Ophthalmol 1946;29:1541-52
3. Fraser H, Nash TL, Yan Horn GD, et al. Use of miotic effect in evaluating analgesic drugs in man. Arch Int Pharmacodyn Ther 1954;98:443-51
4. Walser A, Safran AB, Schulz P, et al. Effects of small doses of bromazepam on pupillary function and on flicker perception in normal subjects.(Letter) J Clin Psychopharmacol 1987;7(1):59-60
5. Wasterman ST, Golz A, Komorowski FS, et al. Qualitative measurement of drugs. Laryngoscope 1984;94(2 Pt 1):165-70
6. Adams AJ, Brown B, Flom MC, et al. Alcohol and marijuana effects on static visual acuity. Am J Optom Physiol Opt 1975;52(11):729-35
7. Jasinski DR, Martin WR. Evaluation of a new photographic method for assessing pupil diameters. Clin Pharmacol Ther 1967;8(2):271-2
8. McCarron MM, Schulze BW, Thompson GA, et al. Acute phencyclidine intoxication: incidence of clinical findings in 1,000 cases. Ann Emerg Med 1981;10(5):237-42
9. Moskowitz H, Sharma S, McGlothlin W. Effect of marihuana upon peripheral vision as a function of the information processing demands in central vision. Percept Mot Skills 1972;35(3):875-82
10. Safran AB, Walser A, Roth A, et al. Influence of central depressant drugs on pupil function: an evaluation with the pupil cycle induction test. Ophthalmologica 1981; 183(4):214-9
11. Stapleton JM, Guthrie S, Linnoila M. Effects of alcohol and other psychotropic drugs on eye movements: relevance to traffic safety. J Stud Alcohol 1986;47(5):426-32
12. Eddy NB, Howes HA. Studies of morphine, codeine and their derivatives. VIII. Monacetyl- and diacetylmorphine and their hydrogenated derivatives. J Pharmacol Exp Ther 1935;53:430-9
13. Himmelsbach CK. Studies of certain addiction characteristics of (a) dihydromorphine (Paramorphan), (b) dihydrodesoxymorphine-D (Desmorphine), (c) dihydrodesoxycodeine-C (Descodeine), and (d) methyldihydromorphine (Metopon). J Pharmacol Exp Ther 1939;67:239-49
14. Himmelsbach CK, Andrews HL. Studies on codeine addiction. II. Studies of physical dependence on codeine. Public Health Rep (Suppl) 1941;158:11
15. Fraser H, Isbell H. Pharmacology and addiction liability of D1 and D-propoxyphene. Bull Narc 1960;12:9-14
16. Aschan G, Bergstedt M, Goldberg L, et al. Positional nystagmus in man during and after alcohol intoxication. Q J Stud Alcohol 1956;17:381-405
17. Aschan G, Bergstedt M, Goldberg L. The effect of some antihistaminic drugs on positional alcohol nystagmus. Acta Otolaryngol (Suppl) 1958;140:79-90
18. Tress KH, El-Sobky AA, Aherne W, et al. Degree of tolerance and the relationship between plasma morphine concentration and the pupil diameter following intravenous heroin in man. Br J Pharmacol 1978;5:299-303
19. Inturrisi CE, Yerebely K. Disposition of methadone in man after a single oral dose. Clin Pharmacol Ther 1973;13:923-30
20. Martin WR, Fraser HF. A comparative study of physiological and subjective effects of heroin and morphine administered intravenously in post-addicts. J Pharmacol Exp Ther 1961;133:388-99
21. Tennant FS Jr. Phencyclidine (PCP) addiction. West Covina, CA: Veract, 1986
22. Tennant FS Jr, Tarver A, Seecof B. Cocaine plasma concentrations in persons admitted to outpatient treatment: relationship to treatment outcome. J Subst Abuse Treat 1986;3:24-32
23. Tennant FS Jr. Identifying the marijuana user. Narc Officer 1986;(May-Jun): 43-72
24. Bigelow GE, Bickel WK, Roache JD, et al. Identifying types of drug intoxication: a laboratory evaluation of subject examination procedures. In: Harris LS, ed. Problems of drug dependence 1985. Natl Inst Drug Abuse Res Monogr Ser 1986;67:491
25. Wayman IH, Nathanson LM. Influence of intensity of white light upon pupil diameter of the human and of the rabbit. Soc Exper Biol Med 1942;49:466-70
26. Steinmann WC, Milistein ME, Sinclair SH. Pupillary dilation with tropicamide 1% for funduscopic screening: a study of duration of action. Ann Intern Med 1987; 107(2):181-4
27. Sagaties MJ. Screening for strabismus and amblyopia. Nurse Pract 1982;7(4):19, 22-3
28. Goldwater BC. Psychological significance of pupillary movements. Psychol Bull 1972;77(5):340-55
29. Lidsky A, Kakerem G, Sutton S. Pupillary reactions to single light pulses in psychiatric patients and normals. J Nerv Ment Dis 1973;153:386-91
30. Tennant FS. Rapid eye test to detect drug influence. West Covina, CA: Veract, 1987
31. Janisse MP. Pupil size and effect—A critical review of the literature since 1960. Can J Psychol 1973;14:311-29
32. Ellis CJ. The pupillary light reflex in normal subjects. Br J Ophthalmol 1981; 65(11):754-9
33. Elliott HW, Parker KD, Wright JA, et al. Actions and metabolism of heroin administered by continuous intravenous infusion to man. Clin Pharmacol Ther 1971; 12(5):806-14
34. Nutt BG, Jasinski DR. Comparison of intravenously administered methadone, morphine, heroin, and placebo. Fed Proc 1973;32:693