Editorial on Recent Advances

Cannabis and eye function

Products of the Cannabis sativa plant and its close relatives are used throughout the world to make hashish and marihuana. The physiologically active compounds in these products have been identified as tetrahydrocannabinols (THC). The specific chemical is not clear since Δ9-THC is produced only in an acidic environment. Reports by the Secretary of Health, Education, and Welfare have been made to Congress annually since 1971 and include much of the data available on use and the medical aspects of consumption. One federal report of the Senate Committee on the Judiciary; estimated that in 1973 there were 25,000,000 users. Of this group 10 per cent used cannabis more than six times per week. Based on trends from federal seizures the use doubling time was 1.54 years. In 1973, about 790,000 pounds of marihuana and 50,000 pounds of hashish were seized in the United States. These publications establish that there is a wide variance of use based on geographic region and socioeconomic variables. Although information relative to eye toxicity of THC is modest, because of space limitations only a few reports can be described. These range from “case study” material to elaborately controlled research papers.

Shapiro reported his observations on 350 patients who were cannabis users. All presented with vague eye complaints. Several consistent effects included: (1) decreased intraocular pressure; (2) photophobia and blepharospasm; (3) ciliary injection of the globe; (4) increased visibility of the corneal nerves; and (5) accommodative or refractive changes. All of these effects were reversible. Similar findings were reported by Valk, who studied the eye signs over a period of weeks in five young users (aged 17 to 24). All had normal acuity. All presented pupillary abnormalities (static) with pupillary reactions ranging from the completely paradoxical to hardly reactive. All showed reduced accommodation (range 2.5 to 5 diopters; normal 7 to 11 diopters). Three had conjunctival injection, two of these had iritis. Two had red optic discs and three saw spots during the Amsler test.

Moskowitz, Shania, and Schapero compared visual function in 12 male college students after consumption of a placebo, 310 micrograms Δ9-THC per kilogram of body weight (oral) or 0.69 G. ethyl alcohol per kilogram. No differences were found in dark adaption time to a mesopic level, static (“grating”) acuity, vertical
phoria, supraduction, infraduction, or abduction. Alcohol and marihuana produced moderately debilitating effects on lateral phoria and abduction. These were statistically significant from the placebo effects.

Both lacrimation and intraocular pressure are sharply reduced after smoking marihuana. Hepler, Frank, and Ungerleider found IOP decreases up to 45 percent in nine of eleven subjects after 30 minutes of smoking. Pupillary diameter decreased by about 0.4 mm in five minutes during smoking and there were extensive increases in conjunctival injections. But Flom, Adams, and Jones were able to repeat the intraocular pressure reduction findings only in subjects who were only slightly to moderately experienced with marihuana use and who experienced a subjective "high" and relaxation. Individuals in their sample who used marihuana most showed no or little intraocular pressure drop. Pharmacologically the mechanism by which marihuana affects intraocular pressure is not clear. Green and Pederson found decreased fluid secretion and increased ultrafiltration when THC was applied directly to the isolated ciliary body of the rabbit. Flom, Adams, and Jones conclude the effect of the THC may not be direct in human users, but secondary to the relaxation and general subjective state. Conjunctival injection and other variables were not discussed by these authors.

The physiological and subjective effects of brief smoking (10 minutes) are of limited duration. Pulse rate peaks in about 10 minutes and is near the baseline after three hours. Intraocular pressure mean decrease is maximum in about 60 minutes and subjective "high" peaks at about 30 minutes. Pupillary constriction peaked at five minutes. Clearance of Δ9 THC from human systemic circulation was not complete for about three days after intravenous injection.

Findings relating to the chronic use of cannabis are much more limited than those on acute use. A recent report on visual and ophthalmic effects after 10 years of use compared 39 users and matched controls with equal cigarette (tobacco) consumption. Although differences of statistical validity were found between users and controls none of the differences were so large that pathology could be inferred. Measures were reported on pupil size and responsiveness, intraocular pressure, dark adaptation, acuity, color matching, lacrimation, fundus, and conjunctival injection. The users were not intoxicated during testing. Of particular interest are the results on intraocular pressure, pupil response, and conjunctival injection. Intraocular pressure was found to be slightly (0.7 mm Hg) greater in users. Pupil size and responsiveness was not measurably different between groups, and 16 of the users were judged to have conjunctival injection compared to 13 of the nonusers.

An overview of this literature indicates that there are numerous and complex effects of THC on vision and the eye. These vary with dose and with the individual experience with the drug. The majority of eye effects seem to be confined to the anterior segment and in some ways mimic an irritative process of that region. These effects are transient and seem to produce no cumulative effects of long term clinical significance.

William W. Dawson
Departments of Ophthalmology and Physiology
College of Medicine
University of Florida
Gainesville, Fla. 32610

REFERENCES