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Clinical note

EEG SENSITIVITY TO TELEVISION: EFFECTS OF AMBIENT LIGHTING

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It has been recommended (Jeavons and Harding 1970), and is widely accepted, that patients with television epilepsy should view only in a well-lit room, preferably with a table lamp positioned on the television itself. There are many reasons why this advice appears reasonable: (i) under conditions of bright ambient lighting the pupil will be smaller, (ii) the eye will be light adapted, (iii) scattered light within the eye will reduce the contrast both of the television picture itself and of the 50 Hz flicker of the screen, (iv) any diffuse flicker due to scattered light from the TV will be masked, and (v) unless the viewer re-adjusts his set the contrast between the bright and dark parts of the phosphor will be less. Nevertheless in the course of a study of the physiological mechanisms of television epilepsy (Wilkins et al. 1979) we observed that EEG sensitivity to television seemed to be greater with the room lights on than when they were extinguished.

Material and Methods

Intermittent photic stimulation (IPS) is included in all routine waking diagnostic EEGs in our department. When the clinical circumstances permit, photosensitive subjects are also tested for TV sensitivity. The procedures used to detect sensitivity to IPS and TV and to measure the photosensitivity range (Jeavons and Harding 1975) are described elsewhere (Stefansson et al. 1977; Wilkins et al. 1979).

From 94 consecutive photosensitive patients a series of 16 have been selected who met the following criteria: (1) epileptiform activity was present during TV viewing, with a discharge rate under the most epileptogenic conditions of at least 1/min; (2) spontaneous epileptiform activity was either absent, morphologically and topographically different from that elicited by visual stimulation, or had an incidence markedly lower than that during TV viewing; (3) the discharges were self-limiting and did not increase in incidence or duration with repeated stimulation; (4) the patients had been referred for investigation of TV sensitivity or gave informed consent to act as subjects for research.

All had epilepsy and the diagnoses were as follows: primary generalized epilepsy (6); secondary generalized epilepsy (4); partial epilepsy (2); epilepsy, classification uncertain (4). Ten were female and the mean age was 15.3 years.

The subjects viewed a 620 mm (diagonal measurement) black and white television, initially from a distance of 2 m, which was then progressively decreased until epileptiform EEG activity consistently occurred or a viewing distance of approximately 300 mm (close to the near point of vision) had been reached. If the discharges were of more than 1 sec duration, exposure to TV was limited to repeated periods of up to 10 sec and terminated whenever epileptiform activity appeared. Depending on the nature of the discharge, the liability to paroxysmal activity was quantified as: (i) per cent time paroxysmal activity, (ii) discharges per minute, or (iii) probability of discharge within a 10 sec exposure.

TV stimulation was performed at each viewing distance with fluorescent room lighting both on and off. Once a combination of distance and lighting was found which consistently elicited epileptiform activity, both lighting conditions were tested at least twice. The intensity of ambient illumination with lights on was 3400 lux. However, as the television was placed directly beneath the light the screen was not directly illuminated and when switched off the phosphor had a luminance of 500 nits. Thus the indirect lighting of the television was less bright than that of the background, an effect similar to that of the recommended placement of a table lamp above the set. When the room lights were out the lamp used to illuminate the EEG chart produced an ambient lighting in the patient area of approximately 20 lux. In preliminary

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studies an image was presented on the television screen by CCTV and the contrast and brightness were repeatedly adjusted by two different observers to obtain an optimal picture with room lights on and off. The subject (an old master painting) was such that precise adjustment was required for the details to be visible. No substantial difference was found between the preferred control settings for the lights on and lights off conditions and these were therefore held constant for the subsequent experiments. The first 8 subjects were investigated whilst viewing the painting but the remainder played a television game (shooting wildfowl) which helped to hold their attention on the screen. The presentation was of virtually constant brightness, consisting of images of small birds moving across a background of broad black, grey and white stripes. The white parts of the picture had an intensity of 7000 nits, the black 1500 nits and the mean of the entire screen was 2800 nits. Three subjects (7, 15 and 16) were also tested in daylight (approximately 2000 lux).

Results

The results are set out in Table I. In 2 subjects (1 and 3) it proved possible to obtain estimates of discharge incidence at distances both greater and less than 1 m.

All patients tested at a viewing distance of 1 m or less showed more epileptiform activity in the lights-on condition. In this subgroup, the higher incidence of epileptiform activity with room lighting on is highly significant ($P < 0.001$ by the sign test). Sensitivity at a distance exceeding 1 m was confined to subjects sensitive to IPS at 50 Hz and was greater with lighting out. The associations of distance with 50 Hz IPS sensitivity and with the effects of lighting conditions are also significant ($P < 0.005$ in both cases by Fisher's exact probability test). In the 3 subjects additionally tested in daylight the results were the same as those obtained with artificial lighting.

Discussion

The finding that the majority of patients were more sensitive to TV with the light on was unexpected and is difficult to explain on physiological grounds. It will nevertheless be noted that the effects differ at viewing distances greater than or not greater than 1 m. This is of interest in the context of our previous findings (Wilkins et al. 1979) that patients who are sensitive to TV at distances over 1 m (for a 62 cm TV)

TABLE I

Patient	Sex	Age	Type of epilepsy	TV epilepsy	Photosensitivity range (flashes/sec)	Test distance (cm)		Lighting condition associated with greater TV sensitivity	
						≤ m	> m	On	Off
50 Hz IPS-sensitive									
1	F	12	1° G.	+	7—50	{60	105	+	+
2	F	11	2° G.	—	4—60		300		+
3	M	14	?	—	8—57	{60	200	+	+
4	M	15	2° G.	+	14—55		200		+
5	F	15	?	—	11—60	50		+	
6	F	17	?	—	8—56	100		+	
7	F	15	1° G.	—	10—55		300	+	
Not 50 Hz IPS-sensitive									
8	M	24	1° G.	—	8—47	65		+	
9	M	14	Pa	—	13—40	80		+	
10	F	12	Pa	—	8—45	100		+	
11	F	22	1° G.	—	9—40	75		+	
12	F	20	2° G.	+	6—25	40		+	
13	M	12	1° G.	—	6—44	30		+	
14	F	23	?	—	7—48	50		+	
15	F	7	1° G.	—	6—43	100		+	
16	M	12	2° G.	—	10—33	80		+	

are also sensitive to 50 Hz IPS and respond apparently to the 50 Hz flicker of the total screen, whereas those who are not sensitive to 50 Hz respond to the raster and only when viewing at a distance sufficiently close to allow the pattern to be resolved. Thus it appears that in those subjects whose EEGs are activated by the pattern stimulation of the TV at close viewing distances, increased ambient lighting heightens sensitivity. This observation parallels the findings of human psycho-physical experiments which indicate that the subjective contrast threshold for perception of pattern is reduced when the background is illuminated (Estevez and Cavonius 1976).

However, 4 out of 5 50 Hz IPS-sensitive patients who reacted to TV at a greater distance were less sensitive in light than in darkness. This latter finding is based on a small number of subjects and may not be consistent in view of our earlier observation (Van Egmond et al. 1980) that ambient lighting has no systematic effect on IPS sensitivity, and that approximately a third of patients are more sensitive to IPS carried out in a well-lit room.

Though it may be possible to identify 50 Hz IPS-sensitive patients with TV epilepsy in whom sensitivity is consistently reduced by bright ambient lighting, it is clear that in general the advice that people with television epilepsy should view in a well-lit room is at best unsubstantiated and is unsound in the case of those patients whose attacks occur only when they approach the TV set.

In 75% of our patients TV sensitivity was not demonstrable at a viewing distance greater than 1 m (diagonal subtense of screen $< 34^\circ$, line width < 2.26 min of arc). Thus for the majority of people with TV epilepsy the most useful advice may be: either to obtain a set with a small screen (a 19 cm tube subtends 34° at 30 cm, the typical near point of vision) or to view from as far away as possible and to cover one eye when approaching the set (Jeavons and Harding 1975).

Summary

The effect of ambient lighting on EEG sensitivity to television has been tested in 16 photosensitive epileptic patients. Those who were not sensitive to 50 Hz IPS responded to TV at a viewing distance of 1 m or less and showed a consistent increase of EEG activation by television when the room was brightly lit. Most of those who were sensitive to 50 Hz IPS were also TV-sensitive at viewing distances greater than 1 m and the effect was most marked with lights off.

The results are discussed in the context of previous work showing that some patients with TV epilepsy respond to the raster pattern of the screen and some, at greater distance, to 50 Hz flicker.

Résumé

Sensibilité de l'EEG à la télévision: effets de l'éclairage ambiant

L'effet de l'éclairage ambiant sur la sensibilité de l'EEG à la télévision a été étudié chez 16 patients épileptiques photosensibles. Ceux qui n'étaient pas sensibles à la SLI à 50 Hz répondaient à la TV pour une distance de 1 m ou moins et montraient une augmentation sensible de l'activation EEG lorsque la pièce était brillamment éclairée. La plupart de ceux qui étaient sensibles à la SLI 50 Hz se montrèrent également sensibles à la TV, vue à des distances supérieures à 1 m et l'effet était le plus marqué à l'obscurité.

Les résultats sont discutés dans le contexte d'un travail précédent montrant que certains patients épileptiques à la TV répondaient à la vue des lignes de balayage de l'écran, et d'autres, à plus grande distance, à une SLI à 50 Hz.

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