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H. EFFECTS OF MICROWAVE RADIATION ON THE EYE

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At the Graduate Center, we are continuing to expose the eyes of experimental animals (rabbits) to microwave energy at 5.5 kmc/sec. Our immediate goal is the determination of the threshold power levels required to induce changes in the lens when the animals are subjected to acute (single) exposures.

Our earlier work was done with pulsed power using 5 μsec pulses and .001 duty cycle. Descriptions of the apparatus, exposure methodology, preliminary findings, and background information were presented in the previous progress report in this series

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(R-452.28, pages 144-150). Our present work was done with CW microwave power at the same frequency, 5.5 kmc/sec. The results obtained are summarized in Fig. IV-5,

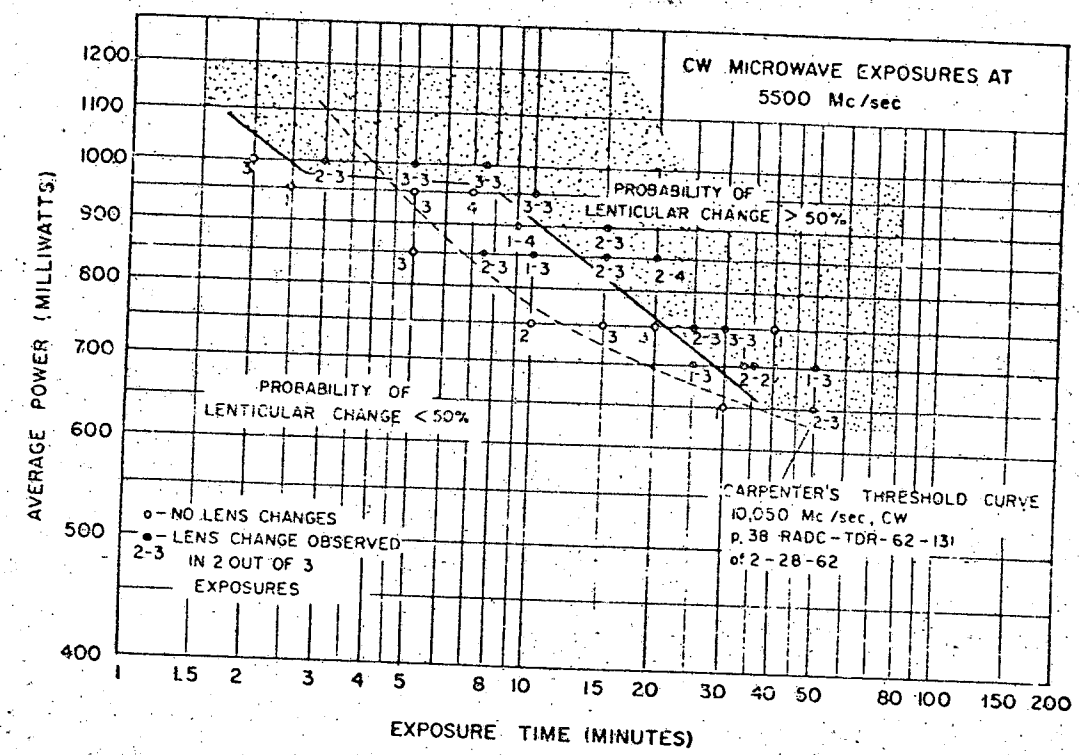

Fig. IV-5 CW microwave exposures at 5500 Mc/sec.

a graphical display of the power levels and exposure times needed to create any kind of detectable change at all in the lens of the irradiated eye. It is divided into shaded and clear sectors representing, respectively, regions in which the probability of lenticular injury exceeds or is less than 50%. On the same graph is shown a threshold curve obtained by Carpenter[1] using CW irradiation at 10.05 kmc/sec. A general similarity is seen to exist between the two curves, even though Carpenter's may have a slightly different significance: that of the boundary between some injury and none at all.

A valid, definitive comparison of the results of our pulsed and CW exposures is not possible as yet; some additional pulsed exposure data is needed. However, indications are that the results are quite similar, and that there is no gross difference between the two threshold curves.

Immediately after each (anesthetized) animal had been exposed, the irradiated eye was examined for evidence of injury. Very often, the pupil was observed to be

constricted; this however, was no indication of whether or not an opacity would subsequently appear in the lens. Sometimes, after irradiation, some cloudiness of the cornea was observed, a condition quite often followed by the appearance of a lens opacity. On the other hand, by no means was cloudiness of the cornea after exposure a prerequisite for the development of an opacity.

If a lens injury had occurred, it was almost always discernible by the fourth day following exposure. It appeared as either a small, localized opacity at the anterior lens surface or as a more extensive cataractous change, but still within the anterior portion of the lens. A clear lens, seen in the photograph of Fig. IV-6, may be compared with a typical lens change, shown in the photograph of Fig. IV-7. The latter depicts a partial lenticular opacity localized to the capsule of the lens and the adjacent cortical substance.

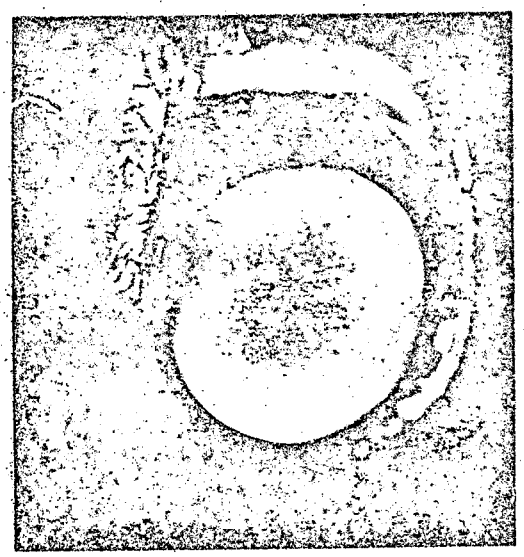

Fig. IV-6 Clear lens (800 mw/15 min, pulsed).

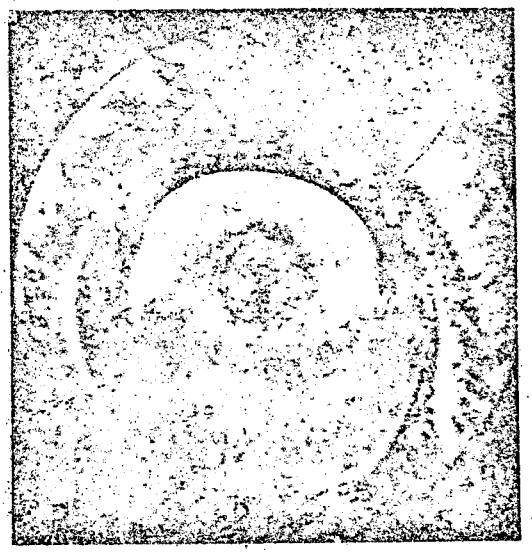

Fig. IV-7 Lens with opacity (600 mw/120 min, pulsed).

Subsequent examinations of the irradiated eye revealed that the opacity either regressed; or grew and then regressed; or underwent continuing change until a cataract was completed. On occasion, the opacity regressed until it was completely resolved.

In conclusion, it is noted that our experiments to date have been conducted under closely controlled conditions that have permitted us to measure the power transmitted directly into the eye. To do this, we have used the irradiated eye as the termination

of a waveguide section, so that the corneal surface was in close proximity to the microwave source; in fact, in contact with it. For a free field exposure, on the other hand, a more natural situation, the microwave source is far removed from the eye. Additional experimental work is required to see whether there is a difference between these two types of exposure.

U. S. Army Medical Research and Development Command
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