ASCORBIC ACID CHANGES IN CULTURED RABBIT LENSES AFTER MICROWAVE RADIATION

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First Stage Evaluation--concerned with the reliability and adequacy of radiation sources, exposure environments, field measurements, dosimetry, etc.

I. Radiation Variables

A. Source Parameters

2.45 GHz CW source (Litton Industries Model L5001 Magnetron)
2.86 GHz pulsed source (Raytheon Model 4J31 Magnetron) with 1 μsec pulse width and 500 Hz pulse rate
No information on pulse rise time or source stability/regulation. Also no information on spectral purity or harmonic content of sources.

B. EM Exposure Environment

Exposures were in a walk-in chamber lined with absorbing material. No information provided on chamber dimensions or on performance characteristics of the absorbing material.
Standard gain horn connected to S-band waveguide was positioned approximately 2 meters above the chamber floor and directed downward. Horn model number (but no manufacturer) was given; therefore, information on gain and beamwidth may not be obtainable. No polarization information was available.
Lenses were placed on a Styrofoam base directly below and approximately one meter from the antenna. During irradiation, petri dish cover was removed to permit direct irradiation. Petri dish fluid level was lowered so that upper one third of the lens was exposed to air.
Temperature was monitored by thermistor whose tip was placed approximately 2.5 cm from the lens. Thermistor leads were perpendicular to the E-field vector.
Average power densities were measured in air by a Narda Model 8305 meter with a 100 mw/cm^2 probe. Power densities above 100 mw/cm^2 were obtained by extrapolation of forward power measurements made with a 30 dB directional coupler and a power meter. Reflected power was not measured.

C. Dosimetry

No effort was made to determine dose.

D. Preparation Container

60 mm plastic petri dish containing a defined culture medium.

This concludes the First Stage Evaluation. With minor difficulties, another investigator could repeat the radiation source, exposure environment, field measurements, dosimetry, etc. used by the authors.

Second Stage Evaluation--concerned with parametric variables such as ambient environment, compatibility of equipment with radiation conditions, etc.

II. Environmental Variables

A. Ambient Environment Within Exposure Area

No information on temperature or its variability, relative humidity or its variability, air flow rate, air quality, etc. was provided. The only information on temperature in the holding area was the 37°C used during lens incubation.

This concludes the Second Stage Evaluation. Another investigator could not repeat the ambient environment used by the authors since information on this environment is not provided; however, precise repetition of this environment may not be extremely crucial to the experimental outcome. Therefore, the literature is judged to be of questionable reliability at this point in the evaluation process.

Third Stage Evaluation--concerned with the logic of the experimental design, experimental design methods, measurement specifications, reduction of data, statistical and experimental analyses, etc.

III. Experimental Design

A. Animal Model System

Lenses from young, adult, New Zealand white rabbits weighing approximately 2 kg. No age information was provided.

B. Pre-exposure Conditions

Lenses were removed aseptically by a posterior approach to the eyeball, and then transferred to a culture medium in petri dishes. Less than two minutes elapsed between first incision and transfer to the culture medium. Culture medium was thoroughly defined. Incubation period and conditions prior to irraidation were defined.

C. Sham-Irradiation Conditions

Not applicable

D. Exposure Regimen

Lenses were exposed in a culture medium for 10-15 minutes at power densities of 0 to 200 mw/cm^2. Precise information on exposure duration is given on the data plot in one case, but not for the other two data plots. Also, one data plot shows power densities up to 250 mw/cm^2, while text presents these densities as 0 to 200 mw/cm^2.

E. Handling and Caging Between Exposures

Not applicable

F. Other Features of Experimental Design

Matched control lenses were exposed to similar time-temperature conditions, but without microwave irradiation. Time temperature profile was induced by indirect, forced, hot air.

IV. Measurement and Observation Procedures

A. Exposure Testing and Observation

After irradiation , lenses were incubated for approximately 24 hours under conditions not specified. The lenses were then removed from the medium and rolled on filter paper to remove adherent media and vitreous, then weighed. Technique used to determine the ascorbic acid is given.

Paired lens (pulsed vs. CW radiation and hot air vs. microwave exposure) were examined with a biomicroscope and inverted microscope for opacities.

B. Sacrifice

Not applicable

C. Statistical Analysis

Resulting data were not statistically analyzed.

This concludes the Third Stage Evaluation and the literature is still considered to be of questionable reliability.

Fourth Stage Evaluation--concerned with results, responses, judgements, conclusions, etc. from the effort described in the literature.

Ascorbic acid decreased significantly in lenses exposed to microwave irradiation, but no differences were found between irradiated and control lenses subjected to identical time-temperature profiles. At a given average

power density, the time-temperature variation was independent of modulation. A decrease in ascorbic acid is apparently a direct thermal effect of microwave radiation. The critical threshold temperature for lens damage was not found.

Results of these investigations need to be evaluated by a person with biological expertise. Until this evaluation is undertaken, this literature continues to be of questionable reliability for use in developing improved standards.