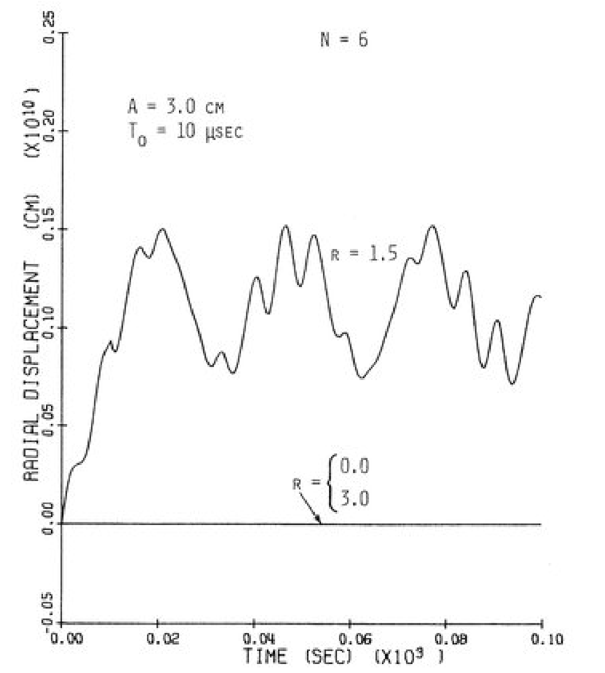

Fig. 5. Radial displacement as a function of time. See Fig. 3 for other parameters.

is shown in Fig. 5. As expected, the displacement is zero at both the center and the surface; the frequency of oscillation is also in accordance with that shown in Fig. 2.

Computations of pressure and displacement have also been performed for other sphere sizes, such as a 7-cm radius sphere simulating an adult human head exposed to 918-MHz radiation. The general features are similar to those illustrated above. For this case, the peak pressure at the center is 6.82 dyn/cm^2 for a peak absorption of 1000 mW/cm^3 and an incident power density of 2183 mW/cm^2. Although specific measurements have not been made for humans exposed to 918-MHz radiation, Frey and Messenger [2] have conducted a series of measurements at 1245 MHz for humans and have reported the threshold peak incident power density to be around 80 mW/cm^2. Assuming that the absorption characteristics at 918 and 1245 MHz are similar, the computed pressure of 0.25 dyne/cm^2 is 62 dB relative to 0.0002 dyn/cm^2. The minimum audible sound pressure for bone conduction is about 60 dB at frequencies between 6 and 14 kHz [25], [26]. Clearly, there is agreement between theory and measurement.

Conclusions

A model for auditory signals generated in humans and animals during microwave irradiation has been derived by considering a spherically symmetric energy absorption pattern and assuming that the impinging plane wave consists of a single rectangular pulse. The results indicate that the frequency of the auditory signals generated is independent of both the frequency of the incident microwave and the absorbed energy distribution; it is only a function of head size and the tissue acoustic property (velocity of acoustic wave propagation). The results also show that there is an optimum pulsewidth for the efficient conversion of microwaves to acoustic energy. The agreement between theoretical calculations and reported experimental measurements of sound frequency and threshold parameters clearly demonstrated the applicability of the thermoelastic stress-production mechanism for microwave-induced hearing in mammals.

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