STUDIES ON THE ELECTROPHONIC EFFECT OF PATHOLOGIC EAR BY STIMULATION WITH ALTERNATING CURRENT.

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1. On 135 cases with pathologic ears the author examined the electrophonic effect by stimulation with alternating current of audible frequency (130~8000 Ω). In 72 cases among 85 conductive deafness, and in 14 out of 50 cases of perceptive deafness, the electrophonic effect were proved positive.

2. The average value in mW. (milli-watt) of the threshold of hearing by electrical stimulation in conductive deaf ears which were radically operated and in otherwise conductively impaired ears is higher as compared to the normal ear at low frequencies and almost the same at high frequencies. (Fig. 1)

From this result it may be inferred that the electrophonic effect is mainly due to the vibration of tympanic membrane at low frequency, and at high frequency mainly to direct stimulation of cochlea. The difference in the value of impedance is due to the difference of anatomy between external and middle ears. Validity of this conception was proved by the experiment measuring the impedance before and after the removal of tympanic membrane on 3 ears of the cat, and the tubal inflation of the 3 human ears which had stenosis on the tube.

3. Radically operated ears has the lowest electrical impedance while it is the greatest in normal ears and nerve deafness with normal eardrum. The values for the ear with a large perforation in the tympanic membrane, the adhesive process of the middle ear or acutely inflamed middle ear come between them. (Fig. 2.)
4. After blocking up the windows (Fenestra cochlearis and Fenestra vestibularis) with wax, in two radically operated ears, the threshold of hearing by electrical stimulation was found increased at lower frequencies, without noticeable threshold change at higher frequencies. That is to say, in lower frequencies the electric current passes chiefly through the windows into the inner ear.

5. The relation between the threshold of hearing by air conduction and that by electrical stimulation is shown in Fig. 3.

Even in severe deafness, the hearing loss may be greater than 40 db. When the electrophonic effect is positive, it is not perceptive deafness, while cases with negative electrophonic effect may be regarded perceptive deafness even if the hearing loss is less than 30 db. Utilizing this relation, electrical stimulation may be clinically applied for differential diagnosis between the conductive and perceptive deafness. This procedure of electric stimulation is also useful to the diagnosis of otosclerosis especially with regard to indication on the fenestration operation.

6. Further, by this test the function of the inner ear on one side may be examined without interference of the other ear. When the ear has tinnitus, however, the test is disturbed, and its result is often uncertain.

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**Fig. 1.**

![Graph](image-url)
Fig. 2.

Relation between the threshold of hearing by air conduction and that by electrophonic effect.

Fig. 3.

Relation between the threshold of hearing by air conduction and that by electrophonic effect.