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POSSIBLE EFFECTS OF EXTERNALLY APPLIED ALCOHOL ON THE RESISTANCE OF THE EARDRUM

W.R.J. Funnell, BioMedical Engineering Unit, McGill University,
3655 Drummond Street, Montreal, Quebec H3G 1Y6.

INTRODUCTION

In past reliability studies of the Zwislocki acoustic bridge, small but consistent changes in eardrum resistance have been reported. In all of these studies alcohol was used in determining the volume of the ear canal. It is suggested here that the resistance changes may be due to the tendency of the alcohol to make the eardrum stiff.

Key words: audiometry, tympanic membrane, alcohols

REVIEW

In testing the reliability of the Zwislocki acoustic bridge, Tillman, Dallos & Kuruvilla (1) measured ear-canal volumes one day, a few days later measured impedances, and a few days after that repeated the impedance measurements. They found consistently smaller resistances the second time. In another test of the reliability of the bridge, Feldman (2) repeated the entire impedance-measuring procedure, including the measurement of the ear-canal volume, the test and retest being at least one week apart. He found consistent increases in the resistance.

Nixon & Glorig (3) also repeated the entire procedure, and did not mention any consistent changes. However, they did not publish enough data to enable one to check for any unnoticed consistency. Feldman (4) presented test-retest correlations, but did not give enough data to show any small trend that might exist.

Tillman et al. offered no explanation of the observed resistance decreases beyond saying that the resistive component appears to be unstable, an explanation which does not explain the consistency. In the Grason-Stadler instruction manual for the Zwislocki bridge, the results of Tillman et al. were explained by the experimenter's tendency to exert more pressure on the bridge as time goes on. This would not explain the opposite trend found in the later data of Feldman. Feldman suggested that the changes were not significant considering the experimental difficulties, but this again does not explain the apparent consistency.

CONCLUSIONS

In all of the above work, the volume of the ear canal was measured by filling it with alcohol. Alcohol is used instead of water because the surface tension of water is higher, meaning that it might fill the ear canal incompletely (5). An hypothesis which might explain the small but consistent resistance changes is that the alcohol tends both to dehydrate the eardrum and to remove natural fats and oils from at least the epidermal layers. This could presumably increase the frictional dissipation due to its vibration, and effectively increase the resistive component of the input impedance of the middle ear. It is assumed that the alcohol would have little effect on the compliance of the eardrum, since the material elasticity depends mainly on collagenous fibres and not on the fats and oils that are present.

According to this hypothesis, in the experiment of Tillman et al. the first resistance measurement would have been affected more than the later one because the ear-canal volume had recently been measured with alcohol, causing an apparent resistance decrease by the time of the second measurement since by that time the drum had at least partially rehydrated itself and restored its original fats and oils. In the experiment of Nixon & Glorig, on the other hand, the alcohol was used again before the second test and might have had an even greater effect than the first time because the eardrum was not yet completely recovered.

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