Ear Canal Shape and Its Impact on Sound Transmission to the Ear Drum at Various Frequencies

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The purpose of this study was to examine the effects of ear canal shape on the ability of sound transmission by providing data at a wide range of sound frequencies. The broad data generated from this study could be served as the first step in corrective ear surgeries, artificial intelligence sound reception, and adaptive hearing aids. Data was collected at frequencies ranging from 50 to 17,500 Hz from a speaker. The sound was passed through 3-D printed ears to a Vernier sound probe that measured sound intensity. All tests were performed in a sound resistant box. The test objects included 3-D printed ears with four variations: one control, one interior region pinched canal, one middle region pinched canal, and one outer region pinched canal. Test results were statistically evaluated by a two-way analysis of variance (ANOVA), which determined that there was a strong interaction effect between my variables of ear canal shape and sound frequency, giving a p-value approaching 0 compared to an alpha value of .05. Due to the strong interaction effect, 13 one-way ANOVA tests and post-hoc Tukey tests were used to determine the significance between ear canals at each frequency, resulting in significance among each individual frequency between ears. The research hypothesis that the pinched interior canal shape at the highest frequencies would perform the best in sound transmission was partially supported; it performed the best at 17,500 Hz, but the second best at 15,000 Hz. In summary, ear canal shape significantly affected sound transmission.

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