Is your telehealth client's hearing change, conductive or sensori-neural?

BACK TO BASICS

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In this time of social distancing, telehealth is becoming more common. And as this current situation gradually resolves, telehealth may continue to be an important tool in the audiological armament going forward.

In addition to counselling, rehabilitation, problem solving, and remote programming that may be available for the client, there are a number of commercially available hearing test apps that may be used for remote hearing testing. While these audiometry hearing test apps may be quite useful, especially in cases where previous hearing assessments are available, they cannot provide diagnostic information regarding the source of a hearing loss or the nature of a change in hearing status. Is the hearing loss, or change in audiogram, conductive or sensori-neural? Following are a few "tricks" to weed out a conductive component.

The /a/ vs. /i/ trick:

The sound /a/ as in 'father' is a low vowel and the sound /i/ as in 'beat' is a high vowel. The relevance is that all high vowels (including /u/ as in 'boot') have very low frequency first formants with their peak energy typically around 125-150 Hz. In contrast, low vowels have higher frequency first formants with their peak energy around 500 Hz.

Outer ear canal occlusion can enhance the low frequency bone conducted sensitivity, and middle ear dysfunction can create a phase differential between air conducted and bone conducted sound- in both cases this would primarily be in the low frequency region (where 250 Hz would be affected more than 500 Hz, with minimal, or no effect above 1000 Hz). Armed with this information a patient can remotely perform their own Weber tuning fork test.

Typically the vowels /a/ and /i/ are equally loud, but with an occluded outer ear such as with wax occlusion, the low frequency energy of the /i/ becomes trapped in the ear canal and thereby is much louder than the /a/. The patient is asked to say the two vowels /a/ and /i/. If the /i/ is louder then there undoubtedly is occlusion, most likely caused by wax. (And if using real ear measurement in a face-to-face test, the difference can be measured to be as high as 20 dB).

This also works as a quick test of middle ear effusion but the results are not as consistent as those where the etiology is outer ear occlusion. A case history including enquires about recent colds or ear infections can supply supplementary information.

The "iBrateMe" trick:

I know that this may be difficult to believe but not everyone walks around with a tuning fork in their pockets. For those clients who are reporting a change in their hearing, especially if it is unilateral, and the client's low-frequency sensori-neural hearing status is relatively good, then use of a low frequency stimulus that can be held to their forehead, can provide the same information as a Weber tuning fork test.

iBrateMe is one of a number of free apps (available on both iOS and Android platforms) that has been designed to provide low frequency therapeutic vibration for sore muscles. The vibration has its primary energy around 40-80 Hz with additional energy peaks extending up to about 200 Hz. In short, it can be used in place of a low frequency tuning fork. Any app that is designed to provide mobile messages (such as iBrateMe or any number of other similar apps) could be used.

Have the client hold their Smartphone to their forehead and if they hear the vibration in their "bad" ear, then this is suggestive of a conductive component; if heard in their better ear, then there may be a (sudden), unexplained sensori-neural asymmetry that needs to be investigated quickly. (It works even better if the client bites down on their Smartphone and holds it between their teeth).

While both of these approaches may be useful, they are not without their limitations. The client being screened via a telehealth approach needs to have access (or know someone who has access) to a Smartphone, needs to have relatively good low frequency hearing, and possess a sufficient level of cognitive awareness to be able to provide valid responses. Both of these easy-to-perform tests can supply the hearing health care professional with additional information to determine whether any change in hearing is "merely" conductive or of a sensori-neural origin.

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