WEBER'S TEST AND RECRUITMENT

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RECRUITMENT is a symptom which is present in lesions of the organ of Corti, typically found in Ménière's disease. When threshold stimuli are applied to the ears they are heard at different loudness levels, one ear hears the tone of similar threshold intensity louder than the other. But at a higher level above threshold, depending on the severity of the cochlear lesion, similar intensity tones are heard as of equal loudness in both ears, the affected ear being said to have recruited. It is quite possible for both ears to be recruiting; any inequality of recruiting would show as recruitment of the more affected ear by the balancing methods of testing. In Ménière's disease this inequality of labyrinth function is an essential to the production of the vertiginous attack. It must be remembered that the cochlea, vestibular apparatus and semicircular canals are in one continuous endolymphatic system. Recruitment is related to the manner in which the hair cells are innervated. The peripheral cells, those nearer the middle of the basilar membrane, are connected to the vestibular nerve by fewer nerve fibres than those placed nearer the modiolus. In a similar manner these peripheral cells receive less vascular connections than the inner cells because the vessels are terminal ones.

Methods of Testing Recruitment

Fowler (1928) described the alternate binaural loudness balance test. The loudness of a tone is matched in both ears and it is shown that the difference in intensity levels, for the same loudness level, decreases as the intensity is raised above threshold level. Bruin-Altes (1946) presented a similar tone simultaneously to both ears by air-conduction and the intensities were adjusted until the loudness was equal. This method of simultaneous balancing is similar in effect to the alternate method of Fowler. Reger (1936) described a monaural loudness-balance test in which tones of different pitch were balanced for loudness against the loudness of a tone at a convenient level above threshold.

The normal ear needs a difference of 2-4 db. in intensity at levels near threshold to enable a difference in loudness to be appreciated. Luscher and Zwislocki (1949) described their difference limen method which determines the difference limen at 40 db. above threshold. Denes and Naunton (1950) measured the difference limen at different levels above threshold. Jerger (1953) measured the difference limen at 15 db. above

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threshold with gradual introduction of the modulation. The Bekesy (1947) method of producing a pure-tone audiogram also measures the difference limen.

Auditory fatigue produces a shift in the threshold level. Huizing (1948) used a tone of 2,000 d.v. at 30 db. above threshold for two minutes. A threshold shift of up to 12 db. was found in normal ears and in a recruiting ear up to 22 db.

As long ago as 1890 abrupt increase of loudness to the reception of the spoken voice in deafened boilermakers was noticed by Habermann. With modern controlled speech testing methods, it can be shown that the difference between the intensity levels between comfortable hearing and real discomfort is lowered in recruiting ears. In addition it can be shown that speech discrimination is lowered in cases of recruitment.

These methods of testing for recruitment need complicated apparatus, the pure tone audiometer, modulation apparatus, apparatus for monitoring speech or gramophone records and controlled amplification. All methods rely as well on the patient's co-operation and understanding of what is expected of him. The audiometer is an accurate instrument only so long as it is constantly checked. Speech discrimination tests are out of place in the consulting room.

Application of Weber's Test

Weber's test is a method of applying an equal stimulus to both ears at the same time. The stimulus starts at maximum intensity and decreases in a regular manner. The intensity of the initial stimulus depends upon the weight of the fork, the excitation force and the frequency of the fork. The forks of higher frequency are of lesser intensity and greater decremental rate.

If a tuning fork is struck and placed upon the vertex or forehead the sound is conducted to both ears. Assuming that the conductive apparatus is normal, and that there is no unequal masking, the sound will be heard at its point of application in the mid-line. A reasonably quiet room is necessary to prevent unequal masking by ambient noise. If one ear is recruiting and the stimulus is above the recruiting level the sound will be heard in the middle. As the intensity of the sound decreases. passing the recruiting level, the sound will be lateralized to the sound side or the side of lesser recruitment. Forks C1, C2 and C3, frequencies 256, 512 and 1,024 have been used and I think the 512 fork to be the most useful. The fork, at maximum intensity can be placed on the vertex for a short time, say two seconds, and then removed. The patient is asked where he heard the sound. Repetition of this observation should be made as a check. The lightly vibrating fork can then be employed in a similar manner. If on this latter test the sound has become lateralized then recruiting exists in the opposite ear to that which heard the light

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tone for the particular frequency of the fork. If recruitment is not obvious other forks should be employed to test the other frequencies. If recruiting exists above the level of intensity of the fork then the sound will be lateralized to the sound side at all intensities of the fork. Over-recruitment, which occasionally occurs, shows as shift from one side to the other.

This recruiting phenomenon may be one of the reasons why Weber's test has been labelled unreliable or confusing in the older textbooks. It had not been appreciated that the sound could be heard on the one side, then in the middle and then on the other side with one application of the fork to the vertex.

Conclusion

I suggest that recruitment can be demonstrated in the great majority of cases of Ménière's disease by a careful application of Weber's test. The utility of this method lies in the fact that it needs the minimum of apparatus, the tuning fork. Further it has the advantage of being easy to carry out in the patient's home and away from the advantages of the consulting room.

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