calculate the binaural hearing loss, the Royal Decree establishes a weighted average of the percentage of loss in both ears. In this weighted average, the better ear weighs five times more than the worst. Thus, we must multiply the percentage of loss of the better ear by 5, add to it the percentage of loss of the worst and divide the result by 6.

It is also interesting to note that when the percentage of binaural hearing loss reaches 96.5%, the patient is recognised as having percentage of disability of 40%, which is the highest awarded due to hearing loss.

References

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Measurement of auditory loss. Equation for its calculation: Response

Medida de la pérdida auditiva. Ecuación para su cálculo: Respuesta

Dear Editor:

We read with great interest the letter from our colleagues in reference to the development of an equation for the calculation of hearing loss. It generates satisfaction to know the concern of other study groups for simplifying and quantifying the degree of hearing impairment for the monitoring of this disorder and the completion of reports to that effect with a clinical, work-related or even legal emphasis.

Indeed, hearing loss is measured in accordance with Royal Decree 1971/1999 from 23rd December, on the Procedure for Recognition, Declaration and Classification of the Degree of Disability.[1] The current legislation works with the thresholds by air pathway detected in conversational frequencies recorded through a liminal tonal audiometry (500, 1,000, 2,000 and 3,000 Hz). In this sense, the sum of these 4 thresholds determines the percentage of hearing loss, considering normal hearing or 0% hearing loss when this sum of thresholds is less than or equal to 100 dB HL.

In relation to this circumstance, the Royal decree provides a table of quantitative equivalences between the percentage of monaural hearing loss and the sum of the 4 frequencies described. In turn, this table of equivalences is derived from the established fact that no hearing impairment is considered in a tone when the threshold by air pathway is equal to or less than 25dB HL.

In a very enlightening manner, our colleagues point out that, above this threshold, by each dB that the threshold increases, hearing loss increases by 1.5%, so that in a single frequency a hearing level of 91.7 dB HL conditions a degree of hearing loss of 100%

These increases enable our colleagues to develop the equation for the calculation of hearing loss in a single frequency:

$$y = 1.5x - 37.5,$$

where "y" expresses the percentage of hearing loss and "x" represents the hearing threshold determined by air pathway in the explored frequency.

Since this equation only concerns a mono-frequency gradient, the degree of loss assumed by the current legislation requires the 4 frequencies already described to be assumed, which effectively leads to the calculation:

$$y = 0.375x - 37.5,$$

where "y" continues to express the percentage of hearing loss, this time in the 4 conversational frequencies, and by law the hearing loss in one ear, and "x" is the result of adding the thresholds by air pathway of these 4 frequencies. Assuming the loss in 4 frequencies requires lowering the value of the slope of the equation to a quarter of its value, from 1.5 to 0.375.

Starting from the same documentary source, our estimate of hearing loss followed a comparative analysis of the 2 quantitative variables offered by the Royal Decree, which indeed are parameters with one decimal point. The result of the equation which we obtained was:

$$y = 0.3745x - 37.395,$$

where "y" and "x" express the same values as those described by our colleagues. It can be appreciated that variations in both the value of the slope (0.3745) and in the intercept (–37.395) are remarkably similar to those reported in the recent article. In addition, our graph showed a linearity coefficient of $R^2=1$, which ultimately generates maximum reliability in the calculation of monaural hearing loss.[2]

Under these conditions, it does not seem to us that the elaboration of our equation can be described as inaccurate.

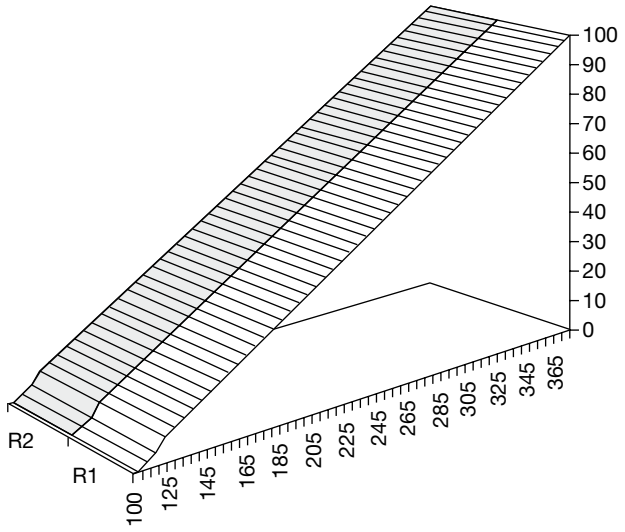

Figure Graph of the two lines obtained in our study (R1) and in the comparative by García Callejo et al. (R2). The Y-axis reflects the sum of hearing thresholds by air pathway in the four conversational frequencies and the X-axis shows the percentage of monaural loss. The changes in the slope, intercept or variations in trend lines are not detectable.

In our opinion, it offers hearing impairment values that are very similar to those given in the tables from the regulatory Royal Decree. The similarity of both equations allows us to accept them both as valid, as they evidence results easily standardised and reproducible by any school which works with them. In fact, we have established a comparative graphical relationship between the 2 equations, appreciating an average difference for all hearing losses equal to 0.099 (Figure).

In any case, this Royal Decree is available to all the scientific population, and it offers easy access to table of equivalences that our team used as a base to generate the equation for quick calculation of hearing loss. For any doubt in the choice of which formula to select, it should suffice to consult the table mentioned, which measures monaural loss from 0 to 100% according to the thresholds of the 4 conversational frequencies.

We agree with our colleagues in clarifying that these equations measure monaural hearing loss, and that binaural loss is obtained by calculating a weighted loss, derived from adding 5 times the hearing loss in the better ear with the hearing loss in the worst, and dividing this result by 6.

As in the letter that motivated this reply, it seems appropriate to us to emphasise the fact that a binaural hearing loss of 96.5% gives a maximum disability of 40%. However, it must be specified that if the patient has undergone a cochlear implant, although the assessment of auditory disorder is performed in accordance with residual hearing function after the appropriate rehabilitation, the percentage of disability will never be less than 33%.

Furthermore, the concomitant presence of tinnitus should be evaluated as a potential disability, always depending on the accompanying hearing loss; in the absence of this, it will be its psychological impact that will condition the disability, thus opening a wide and subjective assessment field. The percentage of disability assigned to the disorder in language acquisition by hearing loss will be combined with this, should they coexist.

Finally, attention is drawn to the fact that considerations on disability secondary to hearing deficit are clearly mentioned in Chapter 13 of this Royal Decree for situations of permanent hearing disorders. This requires a special involvement of the ENT specialist in order to venture a prediction, which is not always simple. It is easy to assume that, in general, perceptual hearing losses have characteristics of irreversibility and thus of permanence. This cannot be said of conductive or mixed disorders, where only the evolution in time or *a posteriori* after medical and/or surgical treatment allows for predictions with a reserved character or pending definition.

The heading of General Regulations of Chapter 1 of the same Royal Decree clearly states that the determination of disabilities should be carried out only in permanent deficiencies with a classification from I to V according to their severity. Furthermore, Chapter 13 specifies that only permanent hearing disorders will be subject to assessment.

However, the General Regulations themselves explain that in the case of diseases with clinical courses in outbreaks, they should be evaluated during the inter-critical periods. Moreover, the frequency and duration of these outbreaks are factors to be taken into account due to the interferences that they cause in the performance of activities in everyday life.

Therefore, to conclude, we very willingly accept a new variation of the equation for the rapid calculation of monaural hearing loss, although we do not believe that it generates substantial differences. We believe that the study groups that use any of these 2 formulas will be able to use them uniformly. Conductive hearing loss requires, under current legislation, a detailed report from the expert that clarifies its potential reversibility, given that, in case of acceptance of a surgical procedure, evaluations should be deferred to it.

References

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