

Correlation analysis of hearing thresholds, validated questionnaires and psychoacoustic measurements in tinnitus patients

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Abstract

One of the most criticized points in tinnitus clinical studies arise from the lack of consensus about measurement methods.

Aim: To evaluate the correlation between audiometric thresholds, pitch matching (PM), minimum masking level (MML), Tinnitus Handicap Inventory (THI) and the Beck Depression Inventory (BDI) in tinnitus patients.

Study design: Prospective, cross-sectional.

Materials and methods: Subjects were submitted to tonal audiometry, PM and MML for tinnitus. They also filled out the THI and BDI. Data was statistically compared for correlation purposes between audiometric thresholds, psycho-acoustic measures and questionnaires.

Results: There was no statistically significant correlation between THI and MML, both in patients with BDI scores under and over 14 points. There was no statistically significant correlation between the worst hearing frequency and PM, as well as between the cut-off frequency and the PM in patients with descending hearing curves in their audiograms.

Conclusions: There is no statistically significant correlation between psycho-acoustic measures (PM and MML), audiometric thresholds, THI and BDI. Tinnitus is a very complex symptom and isolated measures by psycho-acoustic methods; tinnitus and depression questionnaires are not satisfactory.

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INTRODUCTION

Tinnitus can be defined as an auditory sensation which is perceived by the patient, without any external physical source generating the sound. North American data estimates that between 15 and 20% of the population in general have tinnitus and in 20% of these individuals it has a major impact on their quality of life¹. Results from the different tinnitus treatment strategies are rather inconsistent. Nonetheless, since some patients seem to benefit strongly from specific treatment modes, the current trend is that this symptom has a multifactorial origin with different subtypes². One fact which makes the assessment of tinnitus patient particularly difficult is the lack of uniformity concerning its methods of investigation. Numerous publications have been criticized because of its methodology, especially concerning the tinnitus measuring and evaluation technique³. Meikle et al., in a review article from 2008⁴, classified these methods into 4 categories: psychoacoustic tests, scales, questionnaires to assess tinnitus functional effects and questionnaires to analyze the global perceptions of the therapeutic effects.

Psychoacoustic tests have been employed since the 40s⁴ and the four most used ones are: Pitch Match (PM), Loudness Match (LM), Minimum masking level (MML) and Residual Inhibition, (RI). The questionnaires used to assess the functional effects are made up of numerous items which assess tinnitus impact on numerous aspects of daily life⁴. According to some authors, its use guarantees greater reliability in the assessment of tinnitus when compared to other methods⁵. Nonetheless, for other authors, questionnaires for tinnitus assessment are not entirely reliable, since most of them were not developed with the aim of assessing treatment results⁴. Among the most used questionnaires, we list: Tinnitus Handicap Inventory (THI)⁶, Tinnitus Handicap Questionnaire (THQ)⁷ and the Tinnitus Questionnaire (Mini-TQ)⁸. The first two are commonly used in English speaking countries, and the third is used in Europe. In Brazil, the Brazilian-validated version of the THI⁹ is the one most used, as well as the visual-analogue scale³.

Tinnitus can be a significant problem in the lives of patients^{2,3} - bringing about great difficulty in their capacity to adapt to this new reality. Moreover, tinnitus is, in most of the cases, associated to hearing loss, which causes a significant additional impact. Therefore, it is greatly important to assess and, whenever possible, to measure the importance of the participation of the so-called "psychological aspects" as worsening factors for the consequences brought about by tinnitus and its eventual impact on treatment results.

We know that depression is a mood disorder characterized by clinical aspects such as fatigue, reduction

in concentration and attention, low self-esteem and self-confidence¹⁰. Depression can be classified in different levels: mild, moderate and severe, in function of quantity, type and intensity of symptoms¹⁰. Dysphonia is also a characteristic of many psychiatric disorders, including anxiety and mood disorders. It is usually characterized as an unpleasant sensation or annoyance such as sadness, anxiety, irritability or agitation. Etymologically it is the opposite of euphoria¹⁰. The Beck Depression Inventory (BDI)¹¹ is probably the most used self-assessment method to study depression, both in clinical practice as in research¹², having been translated and validated in numerous countries, including Brazil¹².

Parallel to that, experimental studies in animals have shown that cochlear lesions can induce neural plasticity mechanisms both at a cortical and subcortical levels, followed by tonotopic reorganization, similarly to what happens in the amputation of limbs^{13,14}. Cortical neurons, without afferent stimuli coming from the cochlea can suffer neuroplastic changes, with subsequent reduction in their firing thresholds for the frequencies around the affected areas, a theory known as "lesion-edge"¹⁵. Similar mechanisms can be associated to some forms of tinnitus². Moreover, clinical observations have led to the assumption that the cochlear damage, similarly to what happens in the training of perceptions, is followed by a better performance of auditory discrimination in specific frequencies¹⁶. Clinical studies in humans reinforce these concepts, showing through the Frequency Difference Limits (FDL) in patients with sensorineural hearing loss and descending audiometric curves, that small differences are found in those frequencies near the cut-off frequencies¹⁶.

With this study we aim at assessing the correlation between audiometric data, psychoacoustic measures associated to tinnitus (TM and MML) and questionnaires validated for Brazilian Portuguese (THI and BDI).

MATERIALS AND METHODS

Forty-eight (48) patients with tinnitus as chief complaint, who came for treatment in the referral centers were selected, 30 coming from Center A and 18 from Center B. We took off the study those patients younger than 18 years of age, pregnant women, patients with tinnitus for less than 3 months; tinnitus of vascular, muscular or somatosensory origin; patients with TMJ disorders, those with changes seen upon otoscopy; conductive or mixed hearing loss; patients with tympanic curves A-r, A-d, B and C, patients submitted to medication treatment for tinnitus in the past 6 months and those with VIII nerve schwannoma (MRI carried out before inclusion in the study in the cases of asymmetric dysacusia).

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