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Newest therapeutic approaches for tinnitus matching and treatment

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Introduction

Tinnitus can be classified into two categories, based on pathogenesis. Objective tinnitus is produced by sound occurring within the human body, which can be measured and, in some cases, even heard by the examiner. It is described with reference to the source that generates it (fasciculation, noise produced by altered blood flow, etc.);[1] subjective tinnitus is derived from the perception of a sound that depends exclusively on the activity of the nervous system, without any type of mechanical or vibratory activity of the cochlea and independent of any external stimulation.[2] In turn, subjective tinnitus can be classified based on whether the symptoms are caused by discernible disorders of the ear or acoustic nerve temporally associated with lateralised tinnitus on the side of the diseased ear ("otic" tinnitus) or whether the origins are unclear, as there is no association with evident disorders of the ear or acoustic nerve ("non-otic" or "essential" tinnitus).[3] From a qualitative standpoint, non-otic subjective tinnitus is usually represented by a tonal noise or a complex noise that, while similar to known sounds, is never the same as an ambient sound. It originates from the subcortical auditory pathways that do not passively transmit sound signals, but instead regulate their intensity automatically (central auditory gain) and process the evoked neural activity.[4] According to various case studies, the rate of tinnitus varies from 6 to 30% of the general population.[5,6] Most people with tinnitus present a natural history characterized by habituation and tolerance to the "disorder". Nevertheless, in 1% of these cases, tinnitus becomes a disabling condition, based on the level of activation of the limbic and autonomic nervous systems, and requires treatment. The theory of the involvement of the limbic and autonomic nervous systems in tinnitus can be attributed to PJ Jastrebov,[2] who devised the neurophysiological model of tinnitus and the ensuing treatment strategy: tinnitus retraining therapy (TRT), which can ameliorate symptoms in more than 80% of cases.[7,8] The aim of this longitudinal study was to explore whether a newer device based on TRT will be effective in providing relief in patients with both recent onset and persistent tinnitus due to multiple etiologies.

Materials and methods

The present prospective, longitudinal, comparative study was carried out over a two months period from August 2016 to October 2016 in the Department of ENT, PGIMSR & ESIC Model hospital, Basai darapur, New Delhi. Ethical approval was taken from the University ethical committee before starting the study. Oral and written consent was taken from all participants. A Total of 30 patients visiting the department of otorhinolaryngology between August 2016 and October 2016 with clinical history of bothersome tinnitus were selected for the study.

All subjects met the following criteria based on a subjective clinical interview: 1) history of recent onset or persistant tinnitus either primary or secondary. 2) No history of psychiatric illness or seziures. All subjects underwent audiologic tests including pure-tone audiometry, tinnitogram, impedance audiometry, auditory brainstem response, and otoacoustic emission. Laboratory tests included complete blood count, blood chemistry, serum lipid profile, and thyroid function test. A total of 30 patients who met these criteria were enrolled. The patients underwent tinnitus matching with conventional audiometer on day 1 and rematching was done with tinnitus relief device on day 3 by different investigators with blinding the results of initial matching. Following matching a test tone was presented to patient's diseased ear for one minute and time was noted till patient no longer hears the tinnitus. The patients were given tinnitus retraining therapy for 45 minutes each session with audiometer on day 1 and tinnitus relief device on day 3 and the total time when tinnitus was not present was noted by patient interview and continuous counselling was provided to the patient during the course of treatment. The tinnitus handicap inventory was filled at beginning and at the end of one month therapy to quantify the effects of therapy.

Results

Table 1

The study included 30 patients with history of tinnitus consisting of 63.33 % male (n=19) and 36.67% females (n=11). Mean age of patients was 36.4±12.46 years. All the patients had a history of tinnitus with 46.67% having involving Right (n=14) and 53.33% patients with involving left (n=16) ear. In the study 46.67% had recent onset tinnitus with a duration of less than six months (n=14) and 53.33% patients (n=16) had persistent tinnitus with a duration of more than six months.

Most common cause of tinnitus was idiopathic with 70% patients (n=21) and 23.4% (n=7) having menieres disease and 3.33% (n=1) each having otosclerosis and chronic otits media.

Tinnitus matching was done in all patients to match the tone using both audiometer and tinnitus relief device on separate days by different investigators. A total of 73.33% (n=22) were able to match their tinnitus to a tone presented via the audiometer and 26.66% patients did not match their tone using the audiometer were matched using the tinnitus relief device using the high frequency (above 8kHz) in 16.67% (n=5) patients and 6.66% (n=2) using the pattern feature. The test tone test was passed by all the patients with decrease in both the intensity and duration of tinnitus.

The mean THI at the beginning of therapy was 3.43±0.504 and at end of one month was 2.3±0.466. There was statistically significant reduction in THI scores after one month of TRT with both audiometer

and tinnitus relief device but subjective improvement in quality of life was more after TRT with tinnitus relief device.

Table 1 History of tinnitus consisting of different groups

Characteristics	n	%
Male	19	63.33
Female	11	36.67
Mean Age	36.4±12.46	
	14	46.67
Right	16	53.33
Left		
Onset	14	46.67
Recent	16	53.33
Persistent		
Causes		
Idiopathic	21	70
Menieres	7	23.4
Otosclerosis	1	3.33
Com	1	3.33
Tinnitus Matching		
Both Tr And A	22	73.33
Tr High Frequency	5	16.67
Tr Pattern	2	6.66
Mean THI		
Pre Treatment	3.43±0.504	
Post 1 Month	2.3±0.466	

Discussion

Continuous Counseling is regarded as an important component of TRT. The counseling in TRT is intended to explain the patients the mechanisms underlying the tinnitus, based on the Jastreboff neurophysiological model, and to remove negative associations with the tinnitus. This is regarded as important for allowing habituation to the tinnitus to occur.[9] The counseling used in our ENT department was also intended to reduce negative associations with the tinnitus, but was shorter in duration and more simplified. The simplified counseling did not include any teaching about the interactions of various systems of the brain, there was no explanation of the Jastreboff neurophysiological model, and the duration of the initial counseling was only 15 minutes. TRT is an established method of treating patients with both recent onset and persistent tinnitus and typically results in a decline (improvement) in THI scores of 25 to 35 points after 12–24 months of treatment. Studies on the psychometric adequacy of the THI questionnaire suggest that a decline in THI score of 20 points or more can be considered as a statistically significant improvement in perceived tinnitus handicap.

Our results revealed that the THI score declined significantly even after one month of TRT.[10,11] It might reflect individual differences in the patients, differences in the way that patients were selected for inclusion in the studies, or individual differences in the clinicians' personality and attitude. Surr et al., recommended that amplification should be considered in the management of tinnitus and that even patients with limited hearing loss might benefit from HAs. In our study, significant improvement was observed for patients with hearing loss and tinnitus both for those who used HAs and for those who did not. Henry et al., those patients with marginal hearing loss who are not motivated to wear HAs would be unlikely to benefit from the use of HAs as a treatment for their tinnitus.

Conclusion

Tinnitus retraining therapy is an effective modality in treatment of both recent onset and persistent tinnitus. It requires a combination of sound therapy with continuous patient counselling. It can be given using a conventional audiometer and newer devices.

The conventional audiometer lacks in tinnitus matching at high frequencies and pattern tinnitus matching. It also lacks patient's compliance and usability. The tinnitus relief as a newer device made on basis of TRT is effective in both high frequency tinnitus matching and pattern matching and can provide more patient compliance due to its usability and portability

Declaration of conflicting interest

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