

## Original Research Article

# A comparative study between tinnitus masking and tinnitus retraining therapy on perceived tinnitus handicap and cognition

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## ABSTRACT

**Background:** Since last one decade there were no such studies done in India on the efficacy of tinnitus retraining therapy (TRT) on tinnitus treatment. Here, in this study we try to find out whether TRT is an effective tool than tinnitus masking as a treatment procedure of tinnitus in Indian context.

**Methods:** A total of 60 participants (with no prior history of presence of hearing loss) were divided into two groups. Group 1 was consisted of 30 subjects provided tinnitus masking using relief app at the ease of their home environment for 2 months. Group 2 was consisted of another 30 subjects have been provided tinnitus retraining therapy (TRT) for 2months (60 sessions). The design is experimental design. The study was carried out in eight phases.

**Results:** The findings of this study suggested that both the tinnitus masking therapy as well as TRT helped tinnitus sufferers to improve after 60 days of therapy continuation at initial stage. But a significant marked difference was found in terms of performance in participants from group 2 who had undergone TRT i.e., they performed very well after one month of post transfer therapeutic sessions than those who had undergone tinnitus masking therapy.

**Conclusions:** The findings of this study are suggestive of that TRT is more effective than tinnitus masking therapy in tinnitus individuals even after one month of stopping therapy sessions. It also suggests that TRT has a long-term effect on tinnitus management than tinnitus masking.

**Keywords:** Tinnitus, Tinnitus retraining therapy, Tinnitus masking, Subjective perception

## INTRODUCTION

Tinnitus is defined by the American National Standards Institute (ANSI, 1969) as "the sensation of sound without external stimulation."<sup>1-4</sup>

Tinnitus retraining therapy (TRT) is a program of tinnitus rehabilitation that is based on the "neurophysiological model" of tinnitus.<sup>5</sup> The TRT protocol was designed to

facilitate long-term habituation to the conscious perception of the tinnitus signal through "sound therapy" and to the negative reactions through "directive counseling" (based on reports, 70 to 85 percent of the patients achieved significant benefit from both the treatments i.e. TRT and tinnitus masking (TM)).<sup>6-8</sup>

Tinnitus suppression by sound, called TM was proposed for tinnitus masking an external tone is applied to the ear,

only energy in critical band around the tone frequency should be effectively masked.<sup>9,10</sup> The purpose of “tinnitus masking” is to make the tinnitus inaudible. The primary purpose of the sound presentation is to produce a sense of relief from the annoyance caused by the tinnitus sound.<sup>11-13</sup>

### **Need for the study**

Tinnitus is an audiological symptom and it has been recognized that tinnitus masking is a useful method to provide relief from tinnitus.<sup>11,12</sup> Different types of sound enrichment devices are available in the world. In India, commercially available tinnitus maskers are Tinnitus Miracle™ (oticon), Alps Karizma (Alps), and Starkey Xino but the costs are very high. Tinnitus Management Program has not been taken up appropriately in various hospitals and institutions in India due to lack of funding and infrastructure.<sup>14</sup> Audiometer has not been known as a choice for tinnitus masker available in clinical situation. Both tinnitus masking and TRT is effectively used all around the world to treat patients with tinnitus but efficacy of each in Indian context is still unknown. Also, it is unknown that which one among the two is more beneficial for treating tinnitus. Since last one decade there have been no such studies done in India on the efficacy of TRT on tinnitus treatment. This study was also undertaken to come across whether or not TRT is an effective tool for tinnitus treatment and if Resound Relief Android based tinnitus retraining apps freely downloadable from ‘Play Store’ may be of use to the patients as this can reduce the need to be physically present in the clinics. This study consequential to establish the fact that among tinnitus suppression phenomena versus habituation, which modality gives better result in terms of patients’ satisfaction and/or benefit.

Aim of the study was to compare between tinnitus masking and tinnitus retraining therapy on perceived tinnitus handicap and cognition.

Objectives of the study were to compare between tinnitus masking using pure tone audiometer and tinnitus retraining therapy using Resound Relief android apps and directive counselling, using self-perceived tinnitus handicap measured by Tinnitus Handicap Inventory (THI- Newman, Jacobson, & Spitzer, 1996), and on cognition measured by Tinnitus Cognition questionnaire (TCQ- Wilson and Henry, 1998 ).<sup>15,16</sup>

## **METHODS**

This experimental study was done at audiology department of AYJNISHD (D), RC, Kolkata during the period from December 2017-2018 on 60 subjects with the age range between 20 and 60 years (mean age= 45.02 years, SD=3.76). These participants were divided into two groups. Group 1 consisted of 30 subjects with 15 males (mean age= 43.64 years, SD=3.34) and 15 females (mean age= 46.43 years, SD=3.97), who were provided

with tinnitus masking and Group 2 consisted of 30 subjects that includes 15 males (mean age= 44.34 years, SD=4.34) and 15 females (mean age= 45.67 years, SD=3.38), whom TRT was provided TRT through the app.

### **Inclusion criteria**

Participants who were suffering from tinnitus unilaterally from at least last 6 months were included in this study. The participants having normal hearing and speech discrimination was within the range of 80% to 100%. For group 2, all participants had android phones.

### **Exclusion criteria**

The participants excluded from this study were those having neurological disorder and cognitive impairment, phonophobia, misophonia and Hyperacusis, and lastly those with habits of daily intake of caffeine, quinine, aspirin or any other drugs.

Tools or instruments used for this study were diagnostic pure-tone audiometer (Maico MA 53 calibrated) with TDH 39 headphones, GSI 39 Middle Ear Analyzer, Personalized Android based Tinnitus Apps Resound Relief, TCQ and THI.

### **Procedure**

#### *Phase 1*

Written consent was taken for all of the participants participated in this study. Ethical clearance was obtained from the institutes committee.

#### *Phase 2*

Next following audiometric assessment, detailed tinnitus assessment was carried out by using ASHA guidelines, 2005, with reference to Pitch matching (65% had unilateral tonal tinnitus, 30% had noisy tinnitus and 5% had multicomponent tinnitus-unable to match), loudness matching (mean- 45.78 dBHL, SD- 6.87 dB), minimum masking level (MML) had been found  $\pm 5$  dBSL, octave confusion (No one had exhibited octave confusion), Loudness discomfort level (mean- 90.76 dBHL, SD- 4.65) and residual inhibition of 1 minutes (85% had partial inhibition and 15% had complete inhibition. THI and TCQ were lastly administered to obtain the pre therapy measures on self-perceived tinnitus handicap and cognitions.

#### *Phase 3: Clinic based intervention- TM*

For group 1, TM was carried out by using Maico MA 53 with TDH 39 headphones. Participants were given masking (suppression) for 60 sessions at  $MML \pm 20$  dBSL on broadband noise (BBN) for 30 minutes.

**Phase 4: App based intervention- tinnitus retraining therapy**

The subjects of group 2 all had android phones, hence the app was downloaded and they were shown and instructed for its usage. They reported every Monday to give us the data of their usage and they were counselled for total of 8 Mondays in two months periods. They have used apps in total of 60 days, which was taken as 60 sessions equivalent for the study. Participants have been trained to set mixing point in which they are able to hear both the tone i.e. perceived tinnitus and external sound (level were set through Resound Relief Tinnitus App).<sup>5</sup>

TRT was used in three significant therapeutic steps such as Tinnitus intake interview, use of android based tinnitus apps (resound relief) by using headphones of personalized smartphones and in directive counselling.<sup>5,18</sup>

**Phase 5**

All the participants were assessed using THI and TCQ to obtain the post therapy measures on self-perceived tinnitus handicap and cognitions.

**Phase 6**

Participants were retested after 1-month follow-up by using TCQ and THI to check the transfer and maintenance.

**Statistical analysis**

All data were statistically analyzed by using SPSS version 16.0 by means of measures of central tendency (Mean, Standard Deviation) and Paired t test.

**RESULTS**

**Comparison between TM and TRT values pre and post therapy using THI and TCQ scores**

The comparative analysis of THI score between pre and post tinnitus masking therapy of tinnitus participants is presented. In comparison between pre and post therapeutic data of tinnitus participants of the male and female group value. Thus, the overall results indicated that there was significant difference between the pre and post therapeutic condition of tinnitus masking measured in THI score for group-1 and group-2 in both TM and TRT.

Similarly, TCQ score, between pre and post therapeutic condition the female and male. There is presence of significant difference between the both of tinnitus masking measured in TCQ score for group 1 and 2.

**Comparison between post therapy and post transfer data**

To check the post therapy maintenance of the therapy techniques post therapy data and post transfer data of THI and TCQ were compared.

**Table 1: Mean value and paired t-test for equality for means of THI scores and TCQ scores between pre and post tinnitus masking and tinnitus retraining therapeutic data of tinnitus participants.**

Statistical test	THI				TCQ				
	Pre-post male		Pre-post female		Pre-post male		Pre-post female		
	TM	TRT	TM	TRT	TM	TRT	TM	TRT	
Paired-t test 95% confidence interval of the difference	Upper	19.204	19.351	15.394	15.334	45.204	45.604	45.943	45.981
	Lower	-10.465	-10.498	-10.521	-10.531	-32.655	-32.605	-31.251	-31.201
Paired-t test T		-18.957	-18.597	-18.140	-18.450	-40.972	-40.372	-39.104	-39.644
Paired-t test Df		29	29	29	29	29	29	29	29

**Table 2: Paired t-test for equality for means of THI scores and TCQ scores between post therapy and 1 month follow up (post-transfer) tinnitus masking and tinnitus retraining therapeutic data of tinnitus participants.**

Statistical test		Post THI1- Post THI2	Compared mean paired-t results btw post therapy - post transfer data THI		Post TCQ1- Post TCQ2	Compared mean paired-t results btw post therapy - post transfer data TCQ	
		Group 1 and 2	Group 1 (TM)	Group 1 and 2	Group 1 and 2	Group 1 (TM)	Group 2 (TRT)
		Paired-t test 95% confidence interval of the difference	Upper	23.443	28.361	19.418	43.691
	Lower	-15.687	-25.677	-22.024	-20.157	-19.315	20.845
Paired-t test t		-20.372	12.741	-24.616	-23.579	14.782	-24.832
Paired-t test df		29	29	29	29	29	29

The comparative analysis of TCQ score between post therapeutic data and post transfer data of tinnitus masking therapy on group-1 and group-2 was presented in Table 2, the overall results indicated that there was no such significant difference in TCQ scores from post therapy to post transfer data in group-1 who has undergone tinnitus masking therapy.

The comparative analysis of THI Score between post therapeutic data and post transfer data of Tinnitus Retraining therapy on group-1 and 2 is presented in Table 2, the overall results indicated that there was significant difference in THI scores from post therapy to post transfer data in group-2 who has undergone Tinnitus Retraining Therapy. But it was found that there is a marked difference in terms of performance in participants from group 2 who had undergone TRT, i.e., they performed very well after one month of post transfer therapeutic sessions than those who had undergone tinnitus masking therapy.

## DISCUSSION

Although the detailed time-course has not been mentioned anywhere, most of the clinician working with tinnitus masking base their work on random selection of duration. If an external sound can drown out the tinnitus, then it is said to mask the tinnitus.<sup>17-19</sup> The objective of the present study was to assess whether Tinnitus retraining therapy is effective in the management of tinnitus through pre therapeutic data, post therapeutic data and post transfer data based on THI score and TCQ score to compare the efficacy of Tinnitus Retraining therapy than tinnitus masking therapy on two groups of participants having tinnitus.

It may be due to reduced neural activity in tinnitus participants who experienced masking compared to those who did not experience its effect, although the amount of tinnitus attenuation did not correlate with the amount of reduction of neural activity. Tinnitus masking therapy includes provision of masking noise at certain level to mask the tinnitus perception in terms of psychoacoustics. Whereas, TRT includes identification of unwanted thoughts and behaviors hindering natural habituations, challenge their validity and replace them with alternative logical thoughts and behaviors. The outcomes of this study shown that participants those have undergone TRT had shown better improvement as well as maintenance of the treatment approach than those who underwent Tinnitus Masking. This may be due to focus of TRT is on reducing distress by addressing a person's maladaptive appraisal, avoidance, selective attention, and other psychological mechanisms that leads to distress regarding tinnitus.<sup>20</sup>

Findings were similar in all those studies, which revealed that no significant change in subjective loudness of tinnitus was found when compared to a control group, but a significant reduction of tinnitus distress both when

compared to a wait-list control group and to another intervention.<sup>21-24</sup>

## CONCLUSION

The findings of this study are suggestive of that TRT is more effective than tinnitus masking therapy in tinnitus individuals even after one month of stopping therapy sessions. Data analysis did not demonstrate any significant effect in the subjective loudness of tinnitus, or in the depression associated with tinnitus. It was found, however a significant improvement in the quality of life (decrease of global tinnitus severity) suggesting that tinnitus retraining therapy has a positive effect on the way in which people cope with tinnitus. It also suggests that TRT has a long-term effect on tinnitus management than tinnitus masking. TRT can help to relieve individual's distress and annoyance and also reduce attention to the tinnitus sounds by following such steps including understanding about the processes of thinking and behavior and about the effects of tinnitus, by changing the thoughts regarding tinnitus by identifying negative automatic thoughts and substituting those by neutral positive thoughts.

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