APP - BASED AND ONLINE TRT: AN EFFICACY STUDY

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ABSTRACT

The Neurophysiological model provides a logical explanation as to both pathophysiology and treatment rationale of distressing, subjective tinnitus; highlighting the importance of subcortical and cortical auditory areas as well as the auditory related limbic and autonomic nervous system. Under the pandemic – induced new normal situation where one to one close contact even during rehabilitative / therapeutic purposes must be kept at minimum, feasibility of web and app based therapeutic modalities must be explored. Study’s aim to find if significant improvement occurs in tinnitus severity; pre and post TRT using ReSound Relief app to deliver a customized sound therapy; in combination with online counseling sessions. Tinnitus assessments were done, including Tinnitus pitch matching and loudness matching using conventional psycho-acoustical balancing procedures as well as minimum suppression levels. Patient was administered sound therapy via the Resound Relief App (available in play store/iPhone) with parameters conforming to those recommended in the original TRT approach of Jasterboff, and delivered to the patients from their smartphones via HiFidelity headphones. There was a significant decrease in post TRT loudness matching as well as MSL for these 15 subjects. Of these 15 subjects, 9 reported improved and restful sleep post-TRT; and in 5 subjects, there was a shift in perceived tinnitus frequency. In the rest of 7 individuals, 2 showed no change in gross THI scores nor any improvement in perceived The study indicates that App based TRT regimens do provide adequate relief from distressing and debilitating tinnitus, provided the other factors contributing to exaggeration of tinnitus symptoms are controlled.

Keywords: Tinnitus, Resound Relief APP, TRT, THI, MSL

I. INTRODUCTION

Tinnitus is a subjective experience, and treatment of tinnitus involves invoking change in that subjective experience rather than “curing” the tinnitus itself1. Presently viewed as an abnormal, conscious, auditory percept reflecting multiple levels of neuronal dysfunction / dysynchrony involving either or both the peripheral and central nervous system, tinnitus is a symptom which is highly distressing for many of its sufferers and was poorly understood until recently2. Potential mechanisms of benefit include making tinnitus less noticeable, habituation, distracting attention from tinnitus, relaxation, and promoting neuroplastic changes within the brain2 . The Neurophysiological model provides a logical explanation as to both its pathophysiology and treatment rationale, highlighting the importance of subcortical and cortical auditory areas as well as the auditory related limbic and autonomic nervous system; and tinnitus retraining therapy has been the most widely accepted treatment approach3. Defining true, subjective tinnitus as a “phantom auditory perception”3, the model advocates the process of habituation as the only feasible method of treatment, as against psychological, pharmacological, surgical or even tinnitus masking. Tinnitus Retraining Therapy (TRT) / tinnitus habituation aims primarily to habituate reactions of the limbic and autonomic nervous systems by blocking tinnitus-related neuronal activity from reaching both systems, and secondarily to achieve a habituation of the perception where tinnitus-related neuronal activity is blocked before it reaches the level of awareness, and patients are unaware of the presence of tinnitus4. The two major components for achieving habituation are retraining counseling and sound therapy. Sound therapy provides the auditory system constantly with low intensity, neutral auditory signals aimed firstly, to decrease the contrast between tinnitus-related neuronal activity and background neuronal activity, secondly, impede detection of the tinnitus signal, and thirdly, to decrease the exaggerated gain within the auditory pathways. For effective sound therapy, 1) the sound level should be below “mixing point”, 2) fitting should be bilateral 3) low-intensity, cosmetically pleasing, broad-spectrum enriching sounds must be delivered5. Smith et al, stated that 381 out of 643 individuals or 59.3%
had never used an app for management of tinnitus mainly because of lack of awareness and rest of individuals people use for their tinnitus was generated\(^4\). Mehdi studied that 20 out of 30 patients improve their Tinnitus Handicap Inventory-English scores after 8 weeks of Tinnitus Retraining Therapy( 17.7 ± 15.8 vs 5.3 ± 10.5, P = .04)\(^5\). A recent consumer survey by Deloitte reported that smartphone adoption rates are nearing their peak, with as close to nine in 10 adults (aged 18-75 years) having a smartphone that can support mobile applications (apps)\(^6\). A survey for tinnitus apps in the Google Play Store returned a list of almost 250 paid and free apps. Nowadays, several Audiological manufacturing companies have launched software applications which produce and deliver digitally produced and customized sounds through personal smartphones for use in TRT and has made sound therapy easier both for the clinician and the patient. However, there is inadequate clinical trial data as to the efficacy of these app-based sound therapy systems. Smith reported that the main reason for non-use that respondents listed was lack of awareness of the existence of apps that might help their tinnitus (59%) and Other reasons included not being good with technology (20%), not being able to find an app that they thought would be helpful for their tinnitus (13%), or not owning a mobile phone or tablet (12%)\(^7\). Studies shows that post amplification score showed significant improvement as compared to pre-amplification score\(^8\). The Google Android platform revealed the most number of tinnitus apps. The “tinnitus management” consistently outperformed the other categories—containing the most number of digital smart applications and the most number of different features. A small proportion of disinfo apps were got across platforms. There were no significant differences in the total number of features between free and paid apps (except on the Windows platform)\(^9\). As a whole, tinnitus evaluation in practice includes pitch matching, loudness matching, maskability and residual inhibition. This includes imaging tests, most often for individuals with unilateral tinnitus as well as pulsatile tinnitus; for bilateral tinnitus and non-pulsatile unilateral tinnitus having asymmetrical sensory-neural hearing loss a referral to an otolaryngologist is recommended\(^10\). The outcome measures were diverse, but both Internet/app-based and traditional methods like Tinnitus Retraining Therapy, Cognitive Behavioral Therapy, and Acceptance and Commitment Therapy had similar improvements in terms of tinnitus distress and quality of life\(^11\). In the context of tinnitus, the ringing in the ear, these smartphone apps range from relief, management, self-help, all the way to interfacing external sensors to better understand the phenomenon\(^12\). Tinnitus therapy, introduced apps combine acoustic stimulation and music, or serve acoustic stimulation of cortical regions around the tinnitus frequency. Although these apps appear very innovative, their effectiveness has not yet been scientifically proven\(^13\).

II. NEED OF STUDY

Under the pandemic – induced new normal situation where one to one close contact even during rehabilitative / therapeutic purposes must be kept at minimum, feasibility of web and app based therapeutic modalities must be explored. In case of distressing tinnitus, the use of a combined approach of sound therapy by an app-based sound generation and delivery system with online counseling sessions has to be explored for sufficient efficacy for use in regular clinical settings.

III. AIMS AND OBJECTIVES

To find out the difference in tinnitus severity; pre and post TRT using ReSound Relief app to deliver a customized sound therapy ; in combination with online counseling sessions; so as to demonstrate improvement in tinnitus induced symptoms by sound enrichment administered using apps, as per the neuropsychological model.

IV. METHOD

Subject: Twenty Two clients (mean age 42.5 years) with complaint of distressing tinnitus but with normal hearing sensitivity bilateral “A” type tympanogram with present ipsi & contra lateral reflexes & no secondary tinnitus were included in the study.

Materials:

Tinnitus Handicap Inventory (THI)-Bengali\(^14\), Pure tone Audiometer : Madsen Itera II Diagnostics (Otometrics), Madsen Zodiac 901 Immittance Audiometer, ReSound Relief App installed in the smartphones of the respective users
Procedure:

1. All the patients coming to the institute clinic with complaint of significantly loud and distressing tinnitus that is severe enough to hamper their daily living as well as sleep were subjected to: pure-tone audiometry, immittance audiometry, otoacoustic emission and auditory brainstem response; Most Comfortable Loudness (MCL) and Loudness Discomfort Level (LDL).

2. The eligible patients were administered Tinnitus Handicap Inventory whereby the severity of tinnitus was assessed and scaled. Only the patients having an overall score of > 38, i.e moderate up to > 78, i.e catastrophic tinnitus of subjective origin were taken for study.

3. Tinnitus assessments were done, including Tinnitus pitch matching followed by loudness matching using conventional psycho-acoustical balancing procedures. As per literature, continuous pure-tones, pulsed pure-tones, narrowband and white noise were used for matching.

4. Each patient was assessed using Feldmann’s (1984) original test of maskability. Patients exhibiting complete or partial residual masking and convergence and congruence masking curves were chosen for study.

5. Minimum Suppression Level (MSL) and “mixing/blending point” were elicited for each chosen patient.

6. Patient was administered sound therapy via the Resound Relief App (available in play store) and delivered to the patients from their smartphones via HI Fidelity headphones. Parameters of the sound therapy followed the ones recommended by Jasterboff in the TRT regime:
   a) Customized “soundscapes” were designed for each subject, so that the characteristics of tinnitus perception are preserved.
   b) sound level was kept below partial suppression level, i.e “mixing point”, so that habituation may occur; external sound may not induce any negative reactions; and may not attract attention, interfere with communication or affect everyday activities.
   c) bilateral fitting done to avoid asymmetrical stimulation of the auditory system.
   d) recommended to wear 6-8 hours per day.
   e) Patients taught via online progressive relaxation techniques using the relaxation therapy module of the Relief app and recommended to practice at least for 30 minutes each day.

7. online “directive counseling” sessions, as per recommendations of TRT were held twice per week.

8. After continuing the above therapy regimen for 30 days, the patients were re-administered THI to assess any possible improvement in perceived severity of tinnitus and level of mental distress. The patients were also re-assessed for the perceived tinnitus loudness.

9. The pre-and post-therapy tinnitus assessment data were subjected to descriptive statistics and the THI scores were subjected to statistical comparison for significance using paired t-test at 5% level (P=0.003<0.05)

V. RESULTS AND DISCUSSIONS

While the mean Pre TRT was 60 (±8.), the post TRT score was 13.6 (± 7). Subjected to paired-T-test, these scores demonstrated significant improvement at 5% confidence interval (P=0.003<0.05) (Table). After 21 days of competition of TRT & using Resound Relief App, 15 individuals overcame the distressing condition as per average THI score & their tinnitus handicap reduced from “emotional / catastrophic” to “slight functional” with improvement in most of the 25 item THI. There was a significant decrease in post TRT loudness matching as well as MSL for these 15 subjects. Of these 15 subjects, 9 reported improved and restful sleep post-TRT; and in 5 subjects, there was a shift in perceived tinnitus frequency. In the rest of 7 individuals, 2 showed no change in gross THI scores nor any improvement in perceived tinnitus loudness probably due to inconsistency in following the TRT regimen. In rest 5, there were improvements in THI scores, but only up-to moderate degree(Figure). All these 7 subjects had other comorbidities including hypertension, high blood-sugar levels and chronic migraine. Thus, the results indicate adequate habituation in the majority of subjects. It may be postulated that increased exposure to external sounds over time indirectly through the app besides progressive relaxation and counseling towards nature of tinnitus could contribute to reorganization of neural pathways responsible for tinnitus generation and perception.
VI. CONCLUSION & FUTURE DIRECTION

This study showed that when aware of their existence, people do look for and use smartphone apps for tinnitus management. The study indicates that App based TRT regimens do provide adequate relief from distressing and debilitating tinnitus, provided the other factors contributing to exaggeration of tinnitus symptoms are controlled. However, long-term effects of app-based TRT is to be studied further on a larger sample population. It is hoped that altering the pattern of activity within the central auditory system might result in permanent reduction in tinnitus pattern. The choice of the best management app should be guided by a patient’s needs and preferences.

Conflict of interest: Nil

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DATA AVAILABILITY STATEMENT

Raw data were generated at the clinical service of Uttapara Speech and Hearing pvt. Ltd, Hooghly, West Bengal, India are available on request from the Director, iHear Hearing & Speech pvt.Ltd at the above mentioned institutional address; email id: contact@ihear.in; Derived data supporting the findings of this study are available from the corresponding author [Shrutinath Banerjee, Email: Shrutinathbanerjee171097@gmail.com ] on request.

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VII. REFERENCES


  ~:text=On%20the%20basis%20of%20the,habituation%20(removal)%20of%20negative%20reactions


