EFFECT OF COUNSELING AND SOUND ENRICHMENT IN THE MANAGEMENT OF TINNITUS

Register no: A0490016

A masters dissertation submitted in part fulfillment for the degree of Master of Science (Audiology), University of Mysore, Mysore.

ALL INDIA INSTITUTE OF SPEECH & HEARING, MANSAGANGOTHRI, MYSORE-570006.

APRIL 2006.

To,

My Dear Parents,

&

Manjula Ma'm

CERTIFICATE

This is to certify that this Masters Dissertation entitled **"EFFETIVENESS OF COUNSELING AND SOUND ENRICHMENT IN TREATMENT OF TINNITUS"** is a bonafide work in part fulfillment for the Master's degree (Audiology) of the student **Registration no: A0490016.** This has been carried under the guidance of a faculty of this institute and has not been submitted earlier to any other university for the award of any diploma or degree.

Mysore
April, 2006

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CERTIFICATE

This is to certify that this Masters Dissertation entitled **"EFFECTIVENESS OF COUNSELING AND SOUND ENRICHMENT IN TREATMENT OF TINNITUS"** has been prepared under my supervision and guidance. It is also certified that this Masters Dissertation has not been submitted earlier to any other University for the award of any Diploma or Degree.

Mysore.
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DECLARATION

I hereby declare that this masters dissertation entitled **"EFFECTIVENESS OF COUNSELING AND SOUND ENRICHMENT IN TREATMENT OF TINNITUS"** is the result of my own study under the guidance of **Mrs. P. Manjula,** Lecturer, Department of Audiology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for that award of any Degree or Diploma.

Mysore
April 2006

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INTRODUCTION

The word “tinnitus” originated from the Latin word “tinnire” meaning to “ring” or “tinkle” like a bell. There are various definitions of tinnitus; conceptually all of them mean the same. Tinnitus is defined as the perception of sound that results exclusively from the activity within the nervous system without any corresponding mechanical, vibratory activity within the cochlea, and not related to external stimulation of any kind. (ANSI, 1969, cited in J.P.Jastreboff & W.L. Hazell, 2004).

For individuals with clinically significant tinnitus, a handful of treatment methods have gained wide acceptance and generally regarded as a viable treatment option. Two of these methods, Tinnitus Retraining therapy (TRT) and Tinnitus Masking are similar in that they both employ sound therapy although they have different rationales and use different protocols for the purpose (Henry, Schechter, Negler & Fausti, 2002).

The central premise of tinnitus masking (TM) involves the use of a wearable ear level device that delivers sound to the patient’s ear in the order to produce a sense of relief from the annoyance caused by the tinnitus (Vernon & Miekle, 2000). The relief is accomplished by covering up the tinnitus sound or by changing the sound of tinnitus in some way, usually by reducing its loudness. A number of studies have reported clinical outcome data for treatment of a large number of individuals with tinnitus using the basic method of tinnitus masking. The resulting data reviewed by Vernon, and Meikle (2000),

indicate success rate of TM ranging from 45-77%. Limitation of tinnitus masking is that is not equally efficient in alleviating the problem of all clients; in fact, many of the patients cannot be helped solely with this technique. Further, it is imperative to a purchase tinnitus masking device; hence, it may not be a cost- effective treatment.

TRT is a program of tinnitus rehabilitation that is based on the neurophysiologic model of tinnitus and decreased sound tolerance. This program has created a new dimension for both research and clinical endeavors (Jastreboff & Jastreboff, 2003). This model was generated because of a few facts about tinnitus such as –

- There is no difference in psychological characterization of tinnitus between "experiencing" and "suffering",
- There is no vibratory mechanical activity within the cochlea that could be related to the tinnitus perception,
- Severity of tinnitus and its impact do not correlate with its psycho acoustical characterization,
- Other systems separate from the auditory system, are responsible for the severity of tinnitus and determine whether a subject is suffering because of tinnitus or merely experiencing it.

Tinnitus retraining program (Jastreboff, 1990, as cited in J.P.Jastreboff & W.L.Hazell, 2004) of tinnitus rehabilitation is based on the neurophysiological model. The essence of model is that tinnitus becomes problematic, when, in addition to auditory system, two other systems are involved, the limbic system and the autonomic nervous

system. The limbic system controls our positive as well as negative emotions such as fear, thirst, hunger, joy and happiness. Limbic system is strongly connected with all the sensory systems **(**Bast, Zhang & Feldon, 2001). The autonomic nervous system controls all the autonomic body functions. Autonomic nervous system is closely related to the emotional system, controls all the autonomic body functions such as heart rate, breathing, and muscle tone (Brooks, 1987).

According to Jsatreboff (1990), by looking at what is happening in the brain when it is exposed to any new sound, perception of tinnitus as a problem can be understood. The novel sound includes a new pattern of activity within the auditory pathway. This activity will increase in and become regular rather than being random as nerve activity is, in the absence of signal. Further, to understand why perception of tinnitus might create a problem, can be understood by looking what is happening in the brain when it is exposed to any new sound. The novel sound includes a new pattern of activity within the auditory pathway. This activity in groups of nerve fibers will increase and become regular rather than being random as nerve activity in the absence of signal (Jastreboff & Hazell, 2004).

Sounds can be classified in three general categories: neutral (not significant), having some positive (pleasant) meaning, and having a negative (unpleasant) association or meaning. During this process with every new sound, the limbic and autonomic nervous system is activated to some extent. The initial response from the limbic and autonomic nervous system with repetitive appearance will result in a strong activation of limbic and autonomic nervous system every time a subject is exposed to it.

People with tinnitus are typically told, “nothing can be done about tinnitus, you have to learn to live with this” or even worse. Once the tinnitus is linked with something negative it acquires warning label indicating “there might be something wrong”. As with all negative signals, once the tinnitus acquires negative association, it becomes constantly monitored. Thus, the perception of signal is associated with high levels of emotional distress, conditioned reflexes arc is created. In this way, tinnitus related neuronal activity (conditioned stimulus) evokes responses from the limbic and autonomic nervous system. Consequently, the strength of reflex arc and resulting reaction will gradually increase.

Tinnitus retraining therapy (TRT) has two important aspects; one is sound enrichment which aims at habituating the tinnitus by providing continuous low level non-annoying sound rather than masking tinnitus (making tinnitus inaudible). Second aspect includes counseling which will be adjusted to individual patient, bearing in mind the needs of the individual and their general psychological status. The principle extinction of conditioned reflexes is applied to the habituation of tinnitus-evoked reaction by teaching patient why tinnitus is not linked to any danger. Various reports have showed that 70-85% of patient achieved significant benefit from TRT technique (Vernon & Meikle, 2000). The limitation of TRT include its strict adherence to the recommended regimen for 12-24 months, which may be difficult to follow and patients are advised to return to the clinic for a minimum of 3 or 6 weeks and at 3, 6, 12 and 18 month interval.

Need for the Study

In order to overcome certain limitations of each of the techniques, TM and TRT, there is a need to develop a more cost-effective technique. This method should use sound in the environment or recorded sounds, not require tinnitus devices.

Hence, certain features of TM and TRT will be combined and its efficacy on the relief from tinnitus would be evaluated. The amelioration of symptoms with the proposed method may be dependent on certain characteristic of tinnitus subjects, which has not been studied in the past. Hence, along with the effectiveness of the proposed treatment, correlation of degree of hearing loss with rate of improvement, correlation of baseline score or extent of tinnitus with rate of improvement, and effect of duration of tinnitus on rate of improvement also needs to be studied.

Aims of the Study

The aims of the present study included:

- To assess and compare the effectiveness of two viable modes of treatment for subjects with tinnitus, periodic follow-up and correspondence.
- To assess the effect of duration of tinnitus and final outcome with the proposed two methods of treatment.
- To assess the correlation between hearing loss and progress in the subject with this proposed techniques.

- To assess the correlation between the severity of tinnitus (baseline score) and amount of improvement with the proposed treatment method.

REVIEW OF LITERATURE

Literature relevant for the study has been discussed under four headings:

1. Origin of tinnitus.
2. Role of non-classical pathway in perception of tinnitus.
3. Role of neural plasticity in perception of tinnitus.
4. Effectiveness of different approaches in the treatment of tinnitus.

McFadden (1982, cited in A. Axelesson, 1995) suggested " tinnitus is the conscious expression of a sound that originated in an involuntary manner in the head of the owner or may appear to do so". Tinnitus is a common and often debilitating condition. In USA, a general population survey indicated that 32% of the population had some form of tinnitus (National Centre for Health Statistic, 1967, 1980; cited in A. Axelsson & A.R ingdhal, 1989). It can be benign sound that is heard occasionally or it can be devastating roars that occur 24 hours a day accompanied by hyperacusis and distortion of sounds, which present its suffering from sleep or the ability to do any intellectual work.

1. Origin of Tinnitus

Some forms of tinnitus are mostly generated in the ear by abnormal activity of hair cells or abnormal functioning of most peripheral part of the auditory nerve. Electrical currents that are passed to the cochlea can reduce the tinnitus in some patients indicating that this type of tinnitus is generated in the ear (Cazals, Negrevergne & Aran,1978).

If the tinnitus is caused by the deprivation of neural activity in the auditory nerve, electrical current may restore activity. The finding that cochlear implant can alleviate tinnitus in some patients supports this hypothesis **(**Sininger,1987 as cited in A.R.Moller 2003).

Morest, Ard, and Yurgne (1979, as cited in A.R.Moller 2003), studied how the exposure to loud sounds (noise) or administration of ototoxic drugs can cause tinnitus that is associated with hearing loss. Noise and ototoxic drugs are assumed primarily to affect the ear (hair cells) but the tinnitus may in fact be generated in the CNS as a result of deprivation of input or perhaps because of abnormal input from the ear. To complicate the matter further, there is an increasing evidence that hearing loss from noise exposure is not solely affecting hair cells but over exposure to sound is also associated with CNS changes that can be detected morphologically and physiologically (Williot & Lu, 1981). Even presbycusis can have central component, (Williot, Turner & Sundin, 2000). The fact that individual, with hearing impairment can have tinnitus and in particular individuals in whom auditory nerve has been severed can have tinnitus support the hypothesis that tinnitus is not always generated directly in the ear.

Williot (2000) studied why tinnitus occurs only in some individuals with hair cell injuries and this indicates that factors other than injury to the hair cells are necessary for the development of tinnitus. If the deprivation of input to the CNS from the ear always caused tinnitus then one would expect that the auditory nerve would cause tinnitus (Cacace, 2001). This is not the case obviously because auditory nerve section has been used to treat successfully to treat some form of tinnitus (Pulec, 1995).

The changes in the central structures may be caused by a novel input from the injured auditory nerve or reduced input. This hypothesis supported the observation that auditory nerve section does not relieve tinnitus in all patients. An increasing number of studies have shown that most forms of severe tinnitus are caused by abnormal functioning of the nervous system. The expression of neural plasticity plays an important role in the development of such tinnitus. The symptoms and signs that often accompany severe tinnitus may be caused by an abnormal involvement of parts of nervous systems that are not involved involved in processing of sounds (Moller, Moller &Yokota, 1992).

2. Role of Non-Classical Pathway in Perception of Tinnitus

Tinnitus may be caused by changes in the function of nuclei in the ascending auditory pathway (Gerken, Saunders & Paul, 1984) or by re-direction of information to regions of the CNS that normally do not receive this kind of auditory input (Moller 2000). These are the indications that the non-classical auditory pathway may be involved. The non-classical pathways ascend in parallel to the much better known classical pathway. The non-classical pathway receives their main auditory input from the central nucleus of the inferior colliculus, which belongs to the classical ascending pathway. Little is known about the non-classical pathways but studies have found indications that these pathways are active in some patients with severe tinnitus.

The non-classical pathways use dorsal and medial thalamic nuclei as their relay nuclei, whereas, the classical pathways use the ventral thalamic nucleus (Moller, 2000).

The thalamic nuclei of the non-classical pathway project to the association cortices and non-sensory structures, such as those of limbic structure. Whereas, thalamic nuclei of the classical pathways project to the primary auditory cortex. The non-classical pathways have sub-cortical connections to limbic structure through a long chain of neurons where the information is processed and modulated by intrinsic and extrinsic neural activity.

The nuclei of the non-classical pathway perform less specific analysis of sounds than those of classical pathways. Another difference between the two pathways is that the nonclassical auditory pathways receive input not only from the ear but also from organ of other sensory modalities.

3. Role of Neural Plasticity in Perception of Tinnitus

Expression of neural plasticity occurs in all parts of central nervous system (CNS) and it can be caused by many different factors, where deprivation of input, abnormal input or injury are the most common. In fact, it is assumed that the role of neural plasticity is to shift function of injured structures to other parts of CNS termed good plasticity. Bad plasticity often causes hypersensitivity and may re-direct the information to other parts of CNS. Many studies have supported the hypothesis that neural plasticity plays an important role in some forms of tinnitus (Moller, Moller & Jannetta, 1992).

Deprivation of input can activate neural plasticity, which can cause change in the synaptic function (Sandkuhler, Berchtel & Heinke, 2000). Such synapses that are normally not conducting nerve impulses become conducting. It can cause re-direction of information. It has been hypothesized that such rewiring may be responsible for the symptoms that often accompany severe tinnitus. It should be possible to reverse functional changes in the auditory nervous system that are caused by the expression of neural plasticity by appropriate sound stimulation and a method that makes use of that, is tinnitus retraining therapy (TRT).

Thus, there are several investigations on the use of TRT and its variation in the management of tinnitus. There are various factors influencing the improvement in the perception of tinnitus. The present study investigates the effect of counseling and sound therapy through periodic follow -up and correspondence.

4. Effectiveness of Different Approaches in Treatment of Tinnitus

For individuals with clinically significant tinnitus innumerable of treatment options have been tried but a handful of treatment methods have gained wide acceptance and generally regarded as a viable treatment option. The goal of effective management of tinnitus is not necessarily to mask or remove the patient's physical perception of tinnitus sounds. In many cases it is not even possible. According to Dukro, Pollard, Bray, Scheiter (1984), the treatment of tinnitus is more accurately described in terms of "management rather than cure". Many studies have been undertaken to assess the effectiveness of tinnitus management programs or methods. Lindberg, Scott, and Melin,

(1998), illustrated the importance of the long-term follow-up assessment. This investigation assessed the severity of tinnitus in 20 patients nine months after they had completed a relaxation / distraction counseling program. These techniques were aimed at teaching patients a way of handling problem so that they can be displaced from immediate attention in situation in which they earlier become accentuated, thus the purpose was to distract and control the target problem. Based on the results from the nine months follow-up questionnaire study, he reported that significant improvement remained only for "discomfort" from tinnitus. A patient follow-up response to other severity measures such as self-monitoring of tinnitus loudness perception was no longer significantly different from pre-treatment values. Lindberg et al. (1992) reported that the patients improved significantly in discomfort and irritation from tinnitus. There was also reduction in depression associated with tinnitus, but not on psychophysical measures of tinnitus. Improvement was based on the assessment that was administered pre-treatment and again after 4 weeks of counseling sessions.

Sanchez, and Stephens (2000) surveyed 86 patients 18-60 months after they attended psychological counseling at Welch hearing Institute. In general, patients reported more benefits (2.8 per respondents) than shortcomings (0.8 per respondents) regarding their attendance at the clinic. Specific benefits reported by patients included being fitted with hearing aid or tinnitus masker, positive characteristic of the staff, and the opportunity to discuss tinnitus with informed clinicians. Specific shortcomings included patient perception that clinic treatments were ineffective and the persistence of problematic tinnitus after clinic attendance.

Anderson, and Masur (1983) have highlighted the importance of counseling in the reduction of distress associated with a number of chronic conditions including tinnitus but failure in reduction of psychophysical measures. Lindberg, and Jensen (1991) concluded that training in a range of cognitive and behavioral management techniques has also been shown to help reduce the distress associated in living with chronic condition.

Hazell (1985) studied the effectiveness of the masking device in a study of 368 subjects. Questionnaire were administered by the clinical staff, 6 months following treatment to determine the effectiveness of the device of these patients, 69% reported that they were “substantially helped” (helped at least half of the time) and 31% were not substantially helped (helped one fourth of the time or less).

Vernon, and Meikle (2000) combined data that were reported on four large patient samples, comprising a total of 799 patients. Each of these patients was advised to purchase a masking device. Of these patients, 356 (46%) actually purchased the masking device following the 30 days of trial period. Using the rationale that patient purchased the devices only if they found them useful, a success rate of 45% was determined for this combined sample. Vernon, and Meikle (2000) also evaluated the data obtained from tinnitus clinic in Oregon, combined data from these successive overlapping samples of tinnitus patients seen between 1976 and 1989. From this combined sample, 828 patients received recommendation to purchase tinnitus maskers, of which 506 (61%) patients actually purchased the devices after the trial period. Using the same rationale, that a decision to purchase the device was evidence that the device succeeded in producing effective masking, a success rate for this group of patients was determined to be 61%.

Various investigations into the efficacy of tinnitus masking have differed greatly regarding the type of device used, details of treatment protocols, and criteria for defining success. For examples, some clinics used tinnitus instrument (combination hearing aids and maskers) more often than other clinics for their patients with hearing impairment. When applying the use of wearable tinnitus devices as a criterion for defining success, it would seem important that the treatment protocol include access to the optimum range of devices. It is clear that not all clinicians applied the same criteria to the availability and selection of devices.

Although there are no controlled studies documenting the effectiveness of TRT, there are several prospective uncontrolled studies in the literature. A number of clinics are consistent in reporting that the technique is significantly beneficial to 75-85% of their patients. At one tinnitus and hyperacusis clinic, outcome data were evaluated for 156 consecutive patients who received treatment for at least 6 months (Jastreboff, 1998 as cited in Henry, Schechter, Nagler, Fausti, 2002). Patients were identified by clinic staff as success case if they showed at least 20% improvement in two of the three areas of outcome, including performance of daily activities affected by tinnitus, annoyance owing to tinnitus, and percentage of time of awareness of the 152 patients, 129 received full treatment with both sound therapy and directive counseling, of these 129 patients, 81.4% showed improvement according to the success criteria. Jastreboff (1999) reported data from 223 patients who were seen at his clinic. Only patients who had received counseling with sound therapy using either sound generator or hearing aids were used, 81% of the patients showed significant improvement. Criterion used was 20% improvement in two of the three areas of outcome.

Mc Kinney, Hazell, and Graham (1999) conducted an analysis of 182 patients who received treatment. The criteria used for denoting treatment success was minimum 40% improvement in two or more scales evaluating the effects of tinnitus, including annoyance owing to tinnitus, impact of tinnitus on quality of life, tinnitus loudness, and percentage of time aware of tinnitus. All 182 patients received directive counseling related to TRT, of whom 54 received directive counseling only. The rest of them also received sound therapy through the use of ear level sound generator or hearing aids. For counseling only group, 72.2 percent of patients showed improvement. For the group that also that received treatment with sound generators (set at just audible level), 75% showed improvement. For the group with hearing aids, 60.7% improved. Of the various sub-groups, 36 patients received the "truest" form of TRT, i.e., counseling plus sound generators set at the "mixing". For these patients, 83.3% showed improvement. (Kellerhals, as cited in Henry, Schechter, Nagler, and Fausti 2002), reported data from 120 patients who were treated with a program based on the principles and rules of TRT. After an average of 7 months of treatment, 71% of the patients showed improvement in at least two of the activities. From the above studies it is clear that both the methods, tinnitus masking and Tinnitus Retraining Therapy, are not equally efficient in alleviating the problems of all clients. In fact, many patients cannot be helped with these techniques. Further, for tinnitus masking to be implemented it is imperative to purchase tinnitus masker, hence, it may not be a cost-effective technique. Tinnitus Retraining Therapy (TRT) also has some limitation, such as strict adherence to recommended regimen for 12-24 months, which may be difficult to follow. It is obvious from the above studies that, both the treatment techniques seem to be achieving high success rate but it needs to take

into consideration that the proponents of each method have evaluated their own results resulting into investigator bias. In addition, these studies differ in many respects, especially in regard to their criteria for defining success. Thus, it is difficult to compare between and within these studies.

METHOD

The present study was designed to investigate the effectiveness of the proposed two treatments methods - periodic follow-up and correspondence - in the management of tinnitus. The study also assessed the subject's characteristics with rate of improvement. Two groups of subjects were considered. In both groups, the subjects were considered for the study only upon passing the following criteria:

- age range between 15 and 55 years,
- fluency in Kannada language,
- literate (basic qualification being PUC passed),
- with persistent tinnitus, in both ears,
- with and without hearing loss,
- without complaint of hyperacusis,
- hearing loss, if present, less than moderately-severe degree of sensorineural type.

The basic difference between the two groups of subjects was:

Group I: consisted of subjects with persistent tinnitus who could attend the therapy sessions for a period of three months.

Group II: consisted of subjects with persistent tinnitus, but who could not stay for the duration of tinnitus management. These subjects were enrolled for correspondence therapy.

TEST EQUIPMENT

- A calibrated dual channel diagnostic audiometer (MA-53), with TDH-39 headphones and Radio ear B-72 bone vibrator, was used for subject selection.
- A calibrated immittance meter (GSI- Tympstar) was used for the selection of the subjects for the study.

TEST ENVIORNMENT

All the testing was conducted in an air-conditioned, acoustically treated single or double room set-up depending on the test. The ambient noise levels inside the test room were within permissible limits (re: ANSI, 1991, as cited in L.A. Wilber, 1994).

PROCEDURE

The procedure consisted of the following steps:

1. Selection of subjects
2. Audiological evaluation of tinnitus

   2 a. Psychoacoustic measures of tinnitus

   2 b. Self-report tinnitus handicap questionnaire (SR-THQ) by Shanbal, (2001)
3. Management of tinnitus.

1. Selection of Subjects

A detailed case history information was collected from each case. For selection of subjects, case history along with pure tone, speech audiometry and immittance evaluations were carried out. Case history questionnaire that was designed to aid the tester in obtaining important information related to the etiology and the nature of the subjects's tinnitus and to assess the need for treatment.

2. Audiological Evaluation Tinnitus

This included psychoacoustic evaluation and subjective evaluation of tinnitus.

2a. *Psychoacoustic Evaluation of the Tinnitus*

This included, pitch matching, loudness matching, masking (residual inhibition & Feldman's masking curve). These tests were administered before the starting of the treatment and during, and after the treatment to monitor the reduction in with treatment.

2 a (i.) Pitch Matching

This measure attempted to quantify the tinnitus for frequency. Two alternative forced choice (2AFC) method was used (Vernon & Ferwick, 1984, as cited in Schechter & Henry, 2002). Two tones with different frequencies were presented alternatively to the subject and the subject was instructed to indicate which tone was more like his/her tinnitus. After the pitch match was done, octave confusion test was

performed to confirm the pitch match result. Here, the tone selected by the individual as his or her pitch match and a tone one octave above / below that frequency was presented, followed by the presentation of the original pitch. The tone that was selected by the subject to be closest to his/her tinnitus was considered as the pitch of the tinnitus. For this again two alternative forced choice (2AFC) procedure was utilized. If the individual was able to confirm the originally selected pitch, irrespective of other two pitches, then the octave test was considered as negative.

2 a (ii). Loudness Matching

Loudness match was done by using Penner's (1983) method of adjustment technique an ascending procedure. The signal that was matched for the pitch of the tinnitus was presented and the subject was asked to adjust the intensity of a comparison tone until it was barely audible (threshold) and later, matched with the loudness of the signal to the loudness of his tinnitus. The difference in levels between the thresholds and level at which tinnitus was matched for loudness was considered as the loudness of the tinnitus.

2 a (iii). Minimum masking level

Masking curves were obtained by presenting narrow band noise (NBN) at each of the discrete frequencies i.e., 250 Hz, 500 Hz, 1 kHz, 2 kHz, 3 kHz, 4 kHz and 6 kHz, and 8 kHz, and at the frequency of the tinnitus match. Masking noise was presented to the affected ear under headphones starting at an intensity equal to the loudness of tinnitus and was slowly increased while the subject was instructed to indicate when the noise first became inaudible. Sound intensity was then increased in small steps until the subject

reported the tinnitus was no longer audible in that ear. The minimum level at which the subject reported hearing only the external sound and not his or her tinnitus was the level recorded as the minimum masking level (MML) on the masking curve. This was recorded from am audiogram where his/her thresholds were recorded in dB HL. If the MML was greater than the loudness match, success with tinnitus masking was less likely. Masking curves were classified according to Feldman's system (Feldman, 1971). Making curves obtained in seven subjects out of total twenty subjects were convergence type. That is, the hearing threshold curve and the masking curve converged from low to high frequencies. They met at a frequency corresponding to the pitch of the tinnitus and coincided for the higher frequencies

Five subjects out of 20 got congruence type in which almost any noise just above threshold was masking out the tinnitus. Threshold and masking curves practically coincided with an intensity range of 10 dB maximum.

In the remaining eight subjects, the masking curve obtained was persistence type in that the tinnitus could not be masked by any stimulus .

2 a (iv). Residual Inhibition

A white noise at minimum masking level plus 10 dB for 60 seconds was presented to the subjects under headphones. At the end of 60 seconds, the masking noise was removed and the subject was asked to indicate as to whether there was any change in the perception of tinnitus. This residual inhibition was classified into four types (Goldstein & Shulman, 1991).

Residual inhibition type obtained in eight out of the twenty subjects were positive partial type, that is, the subjects reported tinnitus loudness to be less than what was before the measurement of residual inhibition. Negative type residual inhibition was obtained in seven subjects of twenty. That is, no change in tinnitus perception following one-minute of exposure to noise**.** Three of the remaining subjects reported rebound type of residual inhibition that is increase in tinnitus.

2 b .Subjective Evaluation of Tinnitus - Administration of SR-THQ

In addition to case history and psychoacoustic measures, other tinnitus assessment instrument such as Self- Report Tinnitus Handicap Questionnaire (SR-THQ) (Shanbal, 2001) was administered. This questionnaire is given in Appendix A. This instrument was used to assess the subject's perception of the degree of handicap or difficulty caused by tinnitus. It was also used to monitor change with treatment or simply to document the pattern of tinnitus perception over time. Subjects were also asked whether they could hear the tinnitus while watching T.V. or the radio or environmental sounds. This served to reveal the nature of tinnitus and elucidated whether the subject could find psychological distraction or masking with simple environmental sounds.

The base line score was obtained for each subject by giving 4 points for each 'yes' response, 2 points for each 'sometimes' response, and 0 for each 'no' response. In this way all the responses were summed up and a baseline score was obtained for each subject. It was interpreted as higher the baseline score, more was the severity of tinnitus.

3. Management of Tinnitus

This stage consisted of counseling and sound therapy. Each counseling session was tailored, taking into account all the information gathered from each subject. The counseling session contained the following information -

a. Explanation of the result of audiological testing. The function of the peripheral auditory system was explained to the patient with diagrams and copies of the subject test results.

b. Presentation of basic rules of perception including the impact of contrast on signal strength. Subjects were `explained about how neuronal network in the brain are trained to detect important sound automatically. For that, classical example was given such as the ability to hear the sound of our own first name, even in high level of competing background noise and when we are not expecting it. The identical scenario process in tinnitus was also explained, such as the initial signal once recognized and evaluated as important because of its continuous presence, cause tuning of neuronal networks to its pattern, and the auditory system can easily recognize it, even in the absence of other signal. Likewise, loudness perception depends upon the contrast of signal against background.

c. Presentation of the basics of brain function and the interaction of various different systems of the brain. All the subjects were told about how the

brain has the ability to undergo modification and plastic changes. So, the subject was made clear that the retraining of conditioned reflexes is possible but takes time. The role of the other systems in the brain that activated by tinnitus, in addition to the auditory system was also explained. The limbic system in the brain controls emotions and is strongly related to the auditory system.

d. Relating these basic concepts to specific subjects, explaining why tinnitus creates such profound effect.
e. Explanation of theoretical basis of habituation and how it can be achieved.
f. Discussion with the subject about the proposed treatment, including discussion regarding the role and utilization of sound with pictures attached in Appendix 'B'.
g. Answering any additional questions that the subject may have on the basis of neurophysiological model.

Subjects were also explained the rationale and importance of Sound Therapy i.e., maintaining enriched environment of non-annoying sound to maximize treatment effects. In addition to counseling, the subjects in Group I and Group II were given sound therapy. The sound therapy protocol was intended to modify auditory processing at sub-conscious level, so that neural changes facilitated by sound therapy would promote habituation to tinnitus perception.

The counseling was provided periodically once in 25 days in order to remove negative thoughts about tinnitus for only Group I. Counseling for three months by asking subjects to visit in order to monitor the use of sound therapy was done only for Group I. Whereas, subjects in Group II were provided with counseling only once i.e. at the end of the tinnitus evaluation. Examples used for counseling is attached in Appendix 'C'. Subjects were instructed to enrich their sound environment at all times with comfortable, nonannoying type of background sound.

All the subjects in Group I and Group II, in the present study, received recorded cassettes with natural sounds such as wind blowing or water falling, any sound of their choice. The subjects were instructed to play the cassettes at a level below the "mixing " or "blending" point and below any level that would cause annoyance. The mixing point was described to subjects as the point at which the sound and tinnitus just start to mix or blend together. Below the mixing point tinnitus can be heard distinctly. It is the premise of Tinnitus Retraining therapy (TRT) that above the mixing point, the tinnitus percept changes, and this must not occur because subjects cannot habituate to their usual tinnitus if the tinnitus percept is changed during sound therapy. Subjects were instructed to listen to the cassettes or CD to at least 3 hours a day for at least 3 months.

The SR-THQ was administered before, during (at one month interval) and after 3 months of the management program. This was done to monitor the progress in management of tinnitus. The data for each subject in each group were tabulated for statistical analysis.

RESULTS AND DISCUSSION

To investigate the goals of the present study, statistical analysis was carried out using SPSS for windows (version 10.0) software. Self Report - Tinnitus Handicapped Questionnaire (SR-THQ) was administered for both the groups before the starting of the program, during (at every month for three months) and at the end of the program.

Four variables or predictors for outcome of management program were taken into consideration. They were:

1. Management program i.e., periodic follow-up and correspondence.
2. Patient's characteristics i.e., hearing loss in Group I and Group II.
3. Duration of tinnitus in Group I and Group II.
4. Extent of tinnitus, i.e., baseline score in Group I and in Group II.

Statistical analysis was carried out to assess the following:

I. Compare the effectiveness of periodic follow-up and correspondence in the management of tinnitus.

II. Interaction effect of the duration of tinnitus on the rate of improvement.

III. Correlation between rate of improvement and hearing loss.

IV. Correlation between rate of improvement and extent of tinnitus.

I. Comparison of the effectiveness of periodic follow-up and correspondence in the management of tinnitus:

As a first step, to investigate which management program was more beneficial for subjects with tinnitus, the mean score on SR-THQ of Group I was compared with that of Group II over three months period which is depicted in Figure 4.1. In this figure, the X-axis indicates the duration over period of three months and the Y-axis indicates the baseline score on SR-THQ before and after starting the treatment.

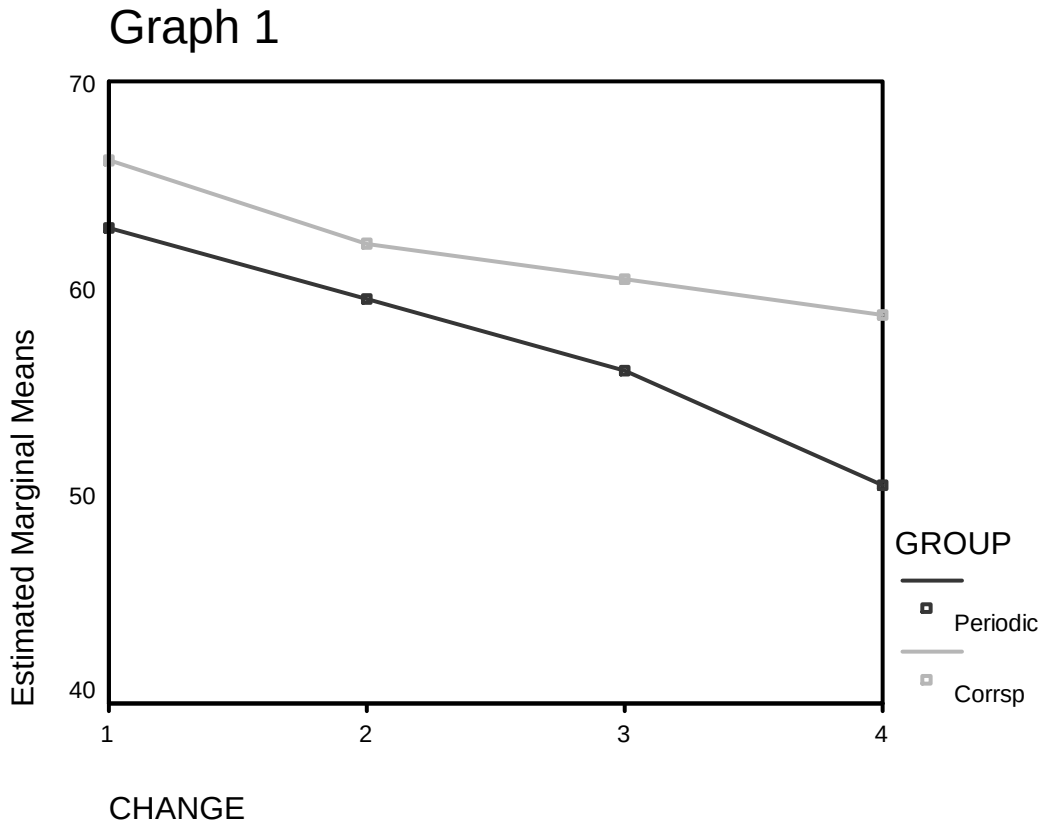

Figure 4.1: Mean score on SR-THQ in Group I and Group II over three months

On perusal of Figure 4.1, it can be understood that the reduction in severity of tinnitus on SR-THQ was more for Group I, who were asked to visit the clinic on periodic

basis, than for Group II who were seeking help through correspondence. Possible attributing factors for this difference could be clinical contact time and monitoring of sound enrichment. Though both the groups were given counseling and sound enrichment, it was not possible to monitor the duration and the loudness of sound used by the Group II for sound enrichment. Whereas, for Group I sound enrichment was monitored in terms of duration in a day for which it was used and the level of sound was adjusted in such a way that it was just “below the mixing point”. Second possible variable contributing for this difference could be clinical contact time, Group I was given more intensive counseling in terms of systematically educating them about tinnitus and by giving different analogies and examples in order to demystify or take out negative association of tinnitus leading to more improvement in Group I. Conversely, Group II subjects received an average of only one or two sessions of counseling. In other words, the subjects in Group I received more “intense of clinical interaction” than Group II.

As in Table 4.1, the mean baseline score of SR-THQ in both the groups of subjects were similar and the improvement in percentage, at the end of three months, was more in subjects in Group I than in Group II.

Table 4.1: Mean baseline score before starting the treatment and mean score after the three months of treatment, on SR-THQ, for Group I and Group II.

Groups	*Mean baseline score (SR-THQ)*	*Mean score after three months (SR-THQ)*	*Improvement in %*
Group I	62.99	50	22%
Group II	66.20	59	15%

In order to investigate whether all the subjects benefited equally irrespective of their baseline score, individual line graphs (Figure 4.2 and Figure 4.3) were plotted.

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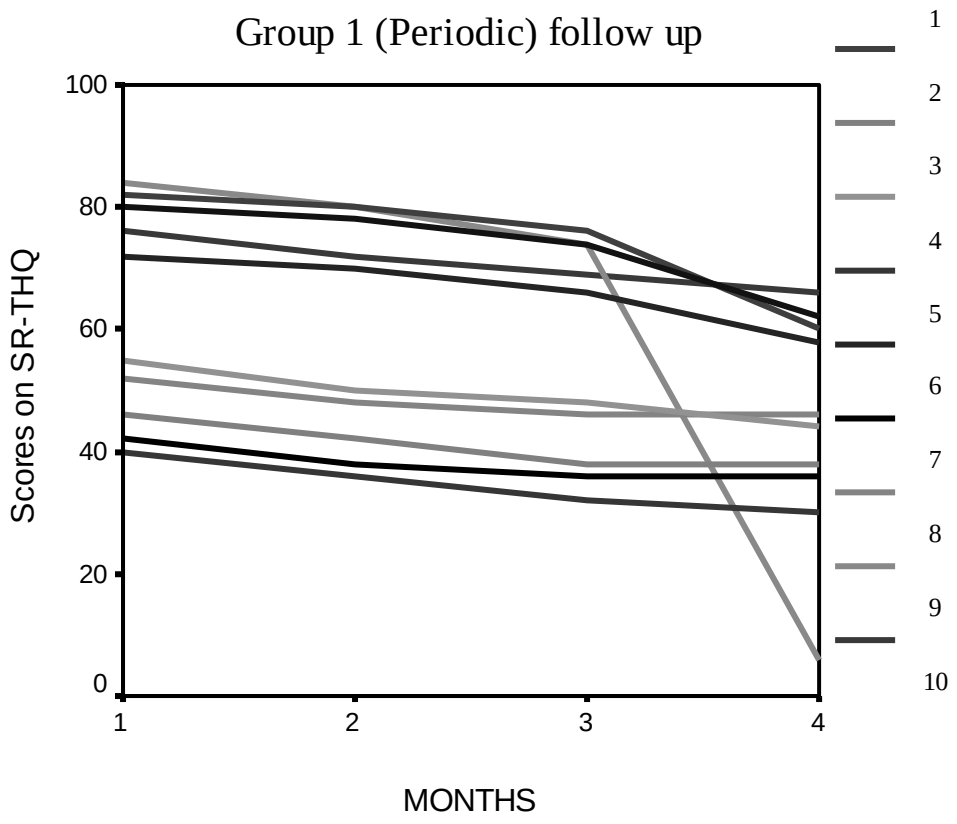
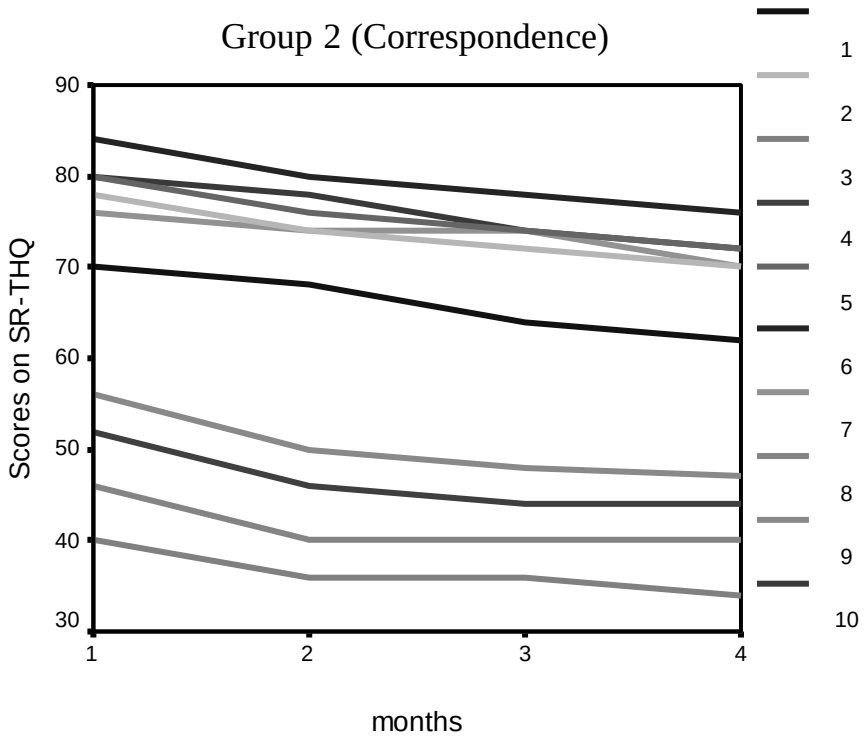


Figure 4.2: Change in individual SR-THQ scores over a period of three months in



Group I

Figure 4.3: Change in individual SR-THQ scores over a period of three months in GroupII

In figure 4.2 eighth patient indicated drastic improvemtn on SRTHQ score could be explained on the basis of amount of hearing loss patient was having, Since this particular patient was having moderate to moderately sever hearing loss, so duration of hearing aid use was more compared to other tinnitus patient with normal hearing sensitivity., leading to more sound enrichment. Second contributing factor couls be the severity of tinnitus, since in the severity was quite high in this particular patient counseling would have benifitted more from counsellin to more extent to break down the negative felling associated with tinnitus.compared to other patients.

Figures 4.2 and 4.3 indicate that the amelioration in tinnitus through correspondence for subjects with less severe problems are comparable to that of subjects

who visited periodically. There was not much difference in amount of improvement for both the groups with less severe tinnitus indicating that there is less requirement of giving periodic and intensive counseling to such groups, as they have less negative association to their tinnitus. This finding supports that of the study by Moller (2000). Conversely, there was more improvement seen for severe tinnitus population than others, supporting Gerken's (1978) study, who evaluated the link between the auditory system with limbic and autonomic system in severe tinnitus cases. Therefore, for this population periodic follow-up visits are warranted to breakdown this connection, expressing the neural plasticity in the parts of central nervous system, supporting the findings of Sandkhuler's (2000) study.

A third observation in this study was with respect to improvement seen only on quantitative measures and not on qualitative or psychoacoustic measures, supporting several studies done by Scott (1992), Sanchez, and Stephens (2000), and, Lindberg, and Jensen (1991).

Table 4.2 shows the psychoacoustic or quantitative measures before starting the management program and at the end of three months of the management program for Group I. The values for all the psychoacoustic measures are not differing significantly between the starting of the management program and at the end of three months of management program for Group I.

However, there was a significant difference on qualitative analysis, i.e., on SR-THQ, suggesting importance of administration of such measures. It also indicates that even when there is a reduction in subjective disturbance from tinnitus three months of management program, it does not correlate with reduction in other quantitative measures.T*able 4.2:* Pre- and post- treatment psychoacoustic measures of different subjects.

Number of subjects	*Pre- or post-treatment*	*Loudness matching (dB)*	*Pitch matching frequency (Hz.)*	*Minimum masking curves type*	*Residual inhibition*
1	Pre-treatment	5	2500	congruence	10 seconds
	Post-treatment	5	2500	conguence	10 seconds
2	Pre-treatment	8	4000	persitence	Negative
	Post-treatment	8	3500	persistence	Negative
3	Pre-treatment	3	5000	convergence	Negative
	Post-treatment	3	5000	convergence.	Negative
4	Pre-treatment	10	3000	conguence	15 seconds
	Post-treatment	8	2500	conguence	15 seconds
5	Pre-treatment	20	6000	peristence	5 seconds
	Post-treatment	18	5000	peristence	5 seconds
6	Pre-treatment	9	3500	peristence	15 seconds
	Post-treatment	9	3500	peristence	15 seconds
7	Pre-treatment	5	2500	peristence	< 5 seconds
	Post-treatment	5	2500	peristence	< 5 seconds
8	Pre-treatment	10	5000	Congruence	10 seconds

	Post-treatment	10	4500	Congruence	10 seconds
9	Pre-treatment	15	8000	congruence	1 minute
	Post-treatment	13	8000	congruence	1 minute
10	Pre-treatment	3	3000	convergence	Negative
	Post-treatment	3	2500	convergence	Negative

The second aim of the study was to investigate the effect of duration of tinnitus on rate of improvement, number of subjects falling in different duration of tinnitus was computed. Table 4.3 shows the number of subjects classified based on duration of tinnitus in Group I and Group II.

Table 4.3: Number of subjects classified based on the duration of tinnitus.

	Duration of Tinnitus					
	0-10 YEARS		10-20 YEARS		> 21 YEARS	
Group I	N	2	N	4	N	4
Group II	N	2	N	5	N	3

'N' in Table 4.3 indicates the number of subjects for both the groups. The duration of tinnitus was self reported length of time the patient had tinnitus and was coded into three categories for analysis.

Out of the ten patients enrolled in Group I, two subjects fell in category I i.e., two subjects to be suffering from tinnitus for less than 10 years, whereas, four subjects fell in the category II, i.e., they reported to be having tinnitus since more than ten years but less than twenty years. The remaining four subjects fell in the category III that was reported to be having tinnitus since last more than twenty one years. In the same way, two subjects out of total ten in Group II fell in category I, five subjects fell in category II, the remaining two subjects fell in category III.

Independent samples t-test was applied to analyze whether there was any significant difference in SR-THQ score between the two groups with respect to duration of tinnitus. Values obtained were ($t = 0.881$, $p < 0.05$) indicating that individuals between the two groups were not significantly different in terms of duration of tinnitus. Since the

difference between the two groups with respect to duration of tinnitus was not statistically significant indicating that both the groups were matched in terms of severity of tinnitus. In second step, one way periodic ANOVA was administered for Group I to analyse the interaction effect of duration of tinnitus on baseline scores i.e., severity of tinnitus as well as rate of improvement. Table 4.4 shows 'F' values obtained to check interaction of duration of tinnitus on baseline and rate of improvement.

Table 4.4: F ratios and significance values for interaction of duration of tinnitus on baseline and rate of improvement

One way ANOVA	***Groups***	***Baseline***	***First month***	***Second month***	***Third month***
F Value	Group I	0.648	0.766	0.744	0.594
Significance	Group II	4.349 (P>0.05)	4.452 (P>0.05)	4.452 (P>0.05)	0.52 (0.05)

There was no statistically significant difference between the groups and within the groups with different duration of tinnitus ($F = 0.648$, $p > 0.05$) for the mean baseline score. In other words, severity of tinnitus does not depend upon duration of tinnitus. Similarly, F values were obtained for first month score, second month score, and third month scores, in individuals with different duration of tinnitus. Values obtained are ($F = 0.766, 0.744, 0.594$, for first, second and third month of management; $p > 0.05$) for first, second, third months scores respectively.

In other words, the rate of improvement with a subject as well as between the subjects is not varying according to duration of tinnitus. Similar findings were obtained for Group II also with $F = 4.349$, $p < 0.05$) for baseline score, and, $F = 4.452, 4.452, .052$; $p > 0.05$, for first, second and third month score respectively. From this it could be inferred that the rate of improvement within a subject as well as between the subjects is not varying according to duration of tinnitus.

The rate of improvement within a subject as well as between the subjects is not varying according to duration of tinnitus, with both the techniques. This is possibly due to the fact that, longer duration of tinnitus does not necessarily lead to more central involvement. Studies have shown that most forms of severe tinnitus are caused by abnormal functioning of the central nervous system. The expression of neural plasticity play an important role in the development of such tinnitus and the symptoms of such tinnitus and the symptoms and signs that often accompany severe tinnitus. This expression of neural plasticity may be lead to an abnormal involvement of parts of nervous system such as limbic and autonomous system (Moller &Yokota, 1992). Development of such central involvement or re-wiring of auditory system with limbic and autonomous system, is dependent upon the number of times subjects received negative reactions about his/her tinnitus. More the number of times the subjects receive negative reaction about his/her tinnitus more the strengthening of involvement of limbic and autonomous system.

Expression of such plasticity is also related to personality traits of the individuals. Some individuals are more anxiety prone, for them any new stimuli that they encounter may create fear and depression. In such cases, tinnitus will be more annoying or debilitating resulting into more and more strengthening of limbic and autonomous system. Since the severity of tinnitus is not uniform in all subjects with the same duration of tinnitus, rather it is affected by personality traits, involvement of autonomous nervous system due to repetitive negative reaction about the tinnitus. Therefore, rate of improvement with both the techniques is also differing across the individuals who are having same duration of tinnitus.

In the final step, in order to find out the correlation between hearing loss and rate of improvement, baseline score and rate of improvement, descriptive statistic analysis was applied to compute the mean baseline score on SR-THQ and mean hearing loss for both the groups.

Table 4.5: Mean and standard deviation of hearing loss (in dBHL) and baseline SR-THQ scores in Group I and Group II.

		Number of subjects	*Mean*	*Std. Deviation*
Hearing loss (dBHL)	Group I	10	26.88	11.54
	Group II	10	28.55	16.50
Baseline SR-THQ score	Group I	10	62.90	17.52
	Group II	10	66.20	16.15

As noted in Table 4.5, mean hearing loss (PTA) for Group I was 26 and 28 for Group II, and mean of the baseline score on SR-THQ was 62.9 for Group I and 66.2 for Group II. Independent sample 't' test was applied to analyze whether there was any significant difference between the two groups with respect to hearing loss . Values obtained were ($t = 0.776$, $P>0.05$) indicating that individuals between the two groups were not significantly differing in terms of the hearing loss. Similarly Independent sample 't' test was applied to analyse whether there was any significant difference between the two groups with respect to baseline score on SR-THQ. i.e. extent of problem. Values obtained were ($t = 0.776$, $P>0.05$) indicating that individuals between the two groups were not significantly different in terms extent of problem.

In third step, Pearson's product moment correlation was applied to Group I to find out the correlation between hearing loss and rate of improvement, in first, second, and third month of treatment. As indicated in Table 4.6, Values obtained were $r = 0.502$, 0.529, and 0.525 respectively), indicating moderate positive correlation. In other words as hearing loss was increasing in subjects with tinnitus the amount of change over a period was more.

Table 4.6: Correlation values between rate of improvement in SR-THQ scores and hearing loss.

GROUPS	*Baseline Score*	*First month*	*Second month*	*Third month*
Group I	0.501	0.502	0.529	0.594
Group II	0.502	.0503	0.522	0.592

A second finding observed in the present study was a moderate correlation between the rate of improvement and hearing loss for an individual with tinnitus. This may be related to various causes of the tinnitus. It has been found that, abnormal activity of hair cells or abnormal functioning of most peripheral part of the auditory nerve generates some forms of tinnitus in the ear. Exposure to loud sounds (noise) or administration of ototoxic drugs can also cause tinnitus that is associated with hearing loss. Noise and ototoxic drugs are assumed primarily to affect the ear (hair cells) but the severe form of tinnitus may in fact be generated in the CNS as a result of deprivation of input or perhaps because of abnormal input from the ear. Such involvement of central nervous system becomes more and stronger as the degree of hearing loss increases. As the central involvement in the tinnitus increases tinnitus becomes more debilitating and annoying. As the severity of tinnitus increases rate improvement also increases in such individuals than with individuals with less severity of tinnitus.

In the final step, Pearson's product-moment correlation was applied to check the correlation between the baseline scores and rate of improvement in first, second and third

month for Group I. As can be noted in Table 4.7, values obtained were r = 0.997, 0.994, 0.999 respectively, indicating that as baseline scores increases, rate of change in scores or rate of improvement also increases. Similar finding were obtained for Group II with r = 0.997, r = 0.994 and 0.999 for rate of improvement in first, second and third month.

Table 4.7: Correlation values between rate of improvement and severity of tinnitus.

GROUPS	***First month***	***Second month***	***Third month***
Group I	0.997	0.0994	0.999
Group II	0.997	0.994	0.999

Future recommendations for the study:

Further study needs to be carried out with more number of subjects so that more generalization of results would occur. Studies can be carried out to see the correlation of rate of improvement and more severe hearing loss subjects. Further, such studies can be also carried out over a more period of time to check for the rate of improvement and optimum period over which treatment can be continued. Since in the present study

patients were asked to visit the clinic after every 25 days, unlike TRT which stresses periodic visits at the 3, 6, 8 months of treatment. Further study can be carried out to check the rate of improvement with more frequent clinical visits at fewer periods between the two visits.

SUMMARY AND CONCLUSION

Tinnitus is a seemingly intangible dimension and various treatment methods have been proposed for individuals with clinically significant tinnitus. Among these several treatment methods for tinnitus management, a few have gained wide acceptance and generally regarded as a viable treatment option. Two of these methods, Tinnitus Retraining therapy (TRT) and Tinnitus Masking are similar in that they both employ sound therapy although they have different rationales and use different protocols for the purpose (Henry, Schechter, Negler & Fausti, 2002).

A range of benefit from these treatment methods has been investigated by various researchers. For treatment of a large number of individuals with tinnitus, using the basic method of tinnitus masking, was reviewed by Vernon and Meikle (2000). This indicated that the success rate of TM was ranging from 45-77%. Though success rate seems to be relatively high, there are a few limitations of their study. First is, proponents of this approach have only evaluated the outcome data, resulting into potential investigator bias. Second limitation of these studies is that tinnitus masking is not equally efficient in alleviating the problem of all clients; in fact, many of the patients cannot be helped solely with this technique. Further, it is imperative to a purchase tinnitus-masking device for implementation of this approach; hence, it may not be a cost-effective treatment.

During the past few years, there has been growing interest to assess the second treatment method, which is TRT. TRT is a program of tinnitus rehabilitation that is based on the neurophysiologic model of tinnitus (Jastreboff &Jastreboff, 2003). This approach is based on the rationale that tinnitus becomes problematic only when auditory system

start connecting with limbic and autonomic system. Various reports have showed that 70-85% of patients achieved significant benefit from TRT technique (Vernon & Meikle, 2000). However, TRT has certain limitations that make its implementation difficult in most of the situations. One of them is its strict adherence to the recommended regimen for 12-24 months, which may be difficult to follow and patients are advised to return to the clinic for a minimum of 3 or 6 weeks and at 3, 6, 12 and 18 month interval.

In order to overcome the above limitation, more practical and cost-effective method that will combine certain features of both the treatments. In addition to this, other objectives that were assessed were, correlation of subject's hearing loss and rate of improvement with the proposed treatment methods, interaction effect of duration of tinnitus with this new treatment method, and correlation between tinnitus severity with rate of improvement. In order to investigate all these objectives, two groups of subjects were considered, Group I, consisted of subjects who could attend the therapy sessions for a period of three months at every 25 days of interval, unlike TRT which stresses therapy session after every 3 months for at least 12 months to 18 months. These sessions involves counseling in order to demystify the negative association of tinnitus along with monitoring sound therapy. Group II, consisted of subjects with persistent tinnitus, but who could not stay for the duration of tinnitus management. These subjects were enrolled for correspondence therapy.

For evaluation of tinnitus, quantitative measures that involved loudness matching, pitch matching, minimum masking curves, residual inhibition were used. Whereas, qualitative measures involved administration of SR-THQ. This questionnaire was

administered before the management program, during the program after an interval of every 25 days, and after the program.

It was found that, more reduction in severity on Self Report - Tinnitus Handicap Questionnaire (SR-THQ) was seen for Group I, who were asked to visit the clinic on periodic basis than group II who were seeking help through correspondence. Second observation made was that maximum improvement is seen in subjects with tinnitus, than subjects with less severe tinnitus. Difference in amount of improvement can be attributed to the more negative association of tinnitus. Since the subjects with more severe tinnitus would probably have more negative association than subjects with less baseline score. Therefore, those with more baseline score benefited with periodic counseling to breakdown their negative association, than those with less baseline score, supporting the study of Moller (2000).

The third observation in this study was with respect to the improvement seen only on quantitative measures and not on qualitative measures, supporting several studies done by Scott (1992), Sanchez and Stephens (2000), and Lindberg and Jensen (1991). The fourth finding obtained in this study was there was no statistically significant difference between the groups and within the groups with different duration of tinnitus ($p > 0.05$) for baseline as well as scores obtained at every months. Indicating that there is no interaction effect for duration of tinnitus with baseline score or rate of improvement. Most probable reason for not getting any interaction effect between the duration of tinnitus and rate of improvement is may be due to each subject with equal duration of tinnitus will not show equal baseline score. Base line score will depend upon a number of times the subject has

received negative reactions about his/her tinnitus. More the number of times patients received negative reaction about his/her tinnitus more the strengthening of involvement of limbic and autonomous system. Since baseline score are differing between among the subjects with same duration of tinnitus, the rate of improvement will also vary. Another objective of the study was to find out correlation between hearing loss and rate of improvement. There was moderate correlation between these two measures, indicating that as hearing loss is increasing reduction in score over a period is more.

In the last step, Pearson's product-moment correlation was applied to check the correlation between the baseline scores and rate of improvement in first, second and third month for both the groups. There is a strong correlation found between these two measures for both the groups.

In conclusion, the proposed methods of treatment can be beneficial for tinnitus subject. But periodic visits are more beneficial for subjects with high baseline score than subject with less baseline score. The most potential factor that was found to be affecting the rate of improvement is severity of tinnitus. More the severity of tinnitus greater will be the improvement. There is no difference in scores before and after the treatment on qualitative measures. Third findings are hearing loss is also moderately correlated with rate of improvement. Fourth finding is, there is no interaction effect between the duration of tinnitus and rate of improvement.

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APPENDIX – A

SELF-REPORT TINNITUS HANDICAP QUESTIONNAIRE
(SR-THQ, ShanblaL, 2001)

Name: Education:
Age/Sex: Occupation:
Phone No./E-mail/Fax: Referred from:

Contact address:

Please tick wherever is appropriate:

Sl. No.	**Questions**	**Yes**	**Some times**	**No**
1.	Do you think tinnitus as a significance problem for you?			
2.	Do you hear tinnitus/sounds all the time?			
3.	Have you noticed changes in the loudness of your tinnitus?			
4.	Have you felt that you can no longer cope with your tinnitus?			
5.	Does tinnitus make you feel difficult to relax?			
6.	Does tinnitus make you feel irritable?			
7.	Does tinnitus make you feel anxious?			
8.	Does your tinnitus interfere with your job or household responsibilities?			
9.	Does tinnitus place stress on you?			
10.	Do you feel as though you cannot escape tinnitus?			

Sl. No.	Questions	Yes	Some times	No
11.	Do you have difficulty in understanding speech when you have tinnitus?			
12.	Do you find it difficult to focus your attention away from your tinnitus and on other things?			
13	Does tinnitus make you uncomfortable to be in quiet?			
14.	Does tinnitus make you feel harder to interact pleasantly with others?			
15.	Does tinnitus make you feel tired or ill?			
16.	Does tinnitus make you feel depressed?			
17.	Because of your tinnitus do you feel frustrated?			
18.	Does tinnitus cause you headache?			
19.	Does tinnitus cause you trouble getting to sleep?			
20.	Do you have difficulty in understanding speech in noisy surroundings?			
21.	Does tinnitus make you feel difficult to concentrate?			
22.	Do you feel your tinnitus is annoying?			
23.	Does tinnitus cause you trouble staying asleep?			
24.	Had any medication caused you to experience changes in your tinnitus?			
25.	Do you experience pain or plugging in the ear?			

APPENDIX B

ILLUSTRATIONS FOR COUNSELING

CANDLE

Candle light analogy was used to explain the importance of sound enrichment. The picture attached below depicts how the brightness of candle light is more noticeable when it is in the dark environment than when there is light around it. Similarly, tinnitus can be more noticeable in quiet, i.e., in the absence of background sound. In a noisy background (sound enrichment), the tinnitus is less noticeable. In this way all the subjects were instructed to avoid silence as much as possible and keep their environment sound enriched.

MOTEL

Imagine yourself a tired and dusty traveler arriving at a motel late at night asking for a room. You are told that there is one room remaining, but that it is currently being re-decorated and there is no electricity connected. As you go towards your room with the

key in your hand the owner remarks that there is also likely a hissing sound in the room due to the heating system which is also under repair. However, it is working quite adequately and you are not being alarmed. You are tired and have a peaceful and uneventful night.

Now imagine a second scenario in which everything is exactly the same up to the point when you are going towards your room. The owner does not comment on the heating system, but remarks that a traveling circus, visiting the area three days before, lost a pair of cobras, and they just found one of them two miles away from the motel. Imagine your experience spent during the night in this room when from time to time you are hearing the hissing sound coming from somewhere in the darkened room. Sleep is impossible, and the night is spent searching for the source of the sound, ever fearful that it might be the snake. Even if the faulty heating system is discovered, there is still the anxiety that some of the sounds might be due to the snake.

The same sound might produce a dramatically opposite reaction of the body depending on the context and the interpretation of what is going on. In a similar fashion exactly the same sound of tinnitus might produce an entirely different reaction depending on the context.

SNAKES IN THE GRASS

The way in which we react to threatening sounds in our environment can be illustrated by the following story. Thousands of years ago when we lived in caves on the hillside, the main pre-occupation was avoiding the presence of predators; for instance, a

passing mammoth, or snakes coming out of the grass looking for lunch. The ability to detect the sound of the snake was crucial for our survival, and moreover our early experience of watching snakes eat our friends and family resulted in the development of a reflex in which an extremely weak, possible snake-sound evokes strong feelings of fear induced by sound of approaching snake, resulting in our rapid movement in the opposite direction. Characteristically these predators do not make much noise or they fail to find their lunch. The ability of the person living in this hostile environment to escape being eaten depended on being able to detect the very small sound of the snake when it is a long way off, and to react very rapidly, as a result of strong feelings of fear (stimulation of the limbic system and autonomic nervous system).

This illustrates how a very weak signal can produce a powerful response in the limbic and autonomic nervous system, if it has a significantly negative meaning. Moreover in the case of the snake, habituation to the sound of the snake should not be easy, because this could result in the failure of this survival reflex and an inability to detect the sound of the snake, which might have fatal consequences.

INABILITY TO SHIFT ATTENTION FROM A STIMULUS INDICATING DANGER

Let us imagine that in the counseling room, in place of a chair in the corner of the room, there is a live and tame tiger. Even if I tell you that this tiger is very gentle and he

hasn’t eaten any patient - since last week - and I am instructing you to focus your attention exclusively on this important explanation of the neurophysiological model to tinnitus, so important for your treatment, you would not be able to avoid monitoring the behavior of this tiger even if you have a reasonable trust in my opinion.

In this case a stimulus is given high priority in the list of demands for our attention, and we are sub-consciously forced to monitor its status, even against our will. Similarly, tinnitus, once it has acquired negative associations indicating danger, is periodically forcing our attention on it, against our will, distracting us from other worthwhile tasks.

DARK STREET IN THE MIDDLE OF THE NIGHT

Walking down a dark street in a foreign city in the middle of the night, there is strong tendency to listen for the smallest sound and to be alarmed by the sound a footstep, or a shadow in a doorway. All sensory systems are in a state of ‘red alert’ with sub-cortical filters wide open. Christmas shopping on a familiar and noisy street where it is easy to collide with other pedestrians and be unaware of the noise of traffic and hustle and bustle, is a different affair. Sub-cortical monitoring filters are shut, and this is the time when you may loose your wallet or handbag!

Auditory filters tend to open and monitor for threatening sounds when we are ‘under threat’ from other life events.

WAITING FOR DENTAL SURGERY

Let's imagine that you are waiting in a dentist's waiting room expecting a root canal treatment on a tooth. Even if you are, at this moment, offered a delicious dinner to eat while you are waiting, you will have great difficulty in enjoying it, or even eating it.

In this case, the fear induced by the anticipation of unpleasant treatment and pain suppresses the appetite and any other pleasant emotions which would normally be evoked by such an offer. Similarly the presence of tinnitus, which induces fear and has strong negative associations, suppresses the enjoyment of life, and through this mechanism has an enormously powerful impact on the quality of life.

CATCHING A PLANE IN THE EARLY MORNING

Imagine that you have to fly to a meeting in the morning which necessitates leaving the house at about 5.00 am. Several alarm clocks are set to ensure that you wake, your spouse is primed to wake you, and your colleague will telephone you at the same time. Despite all these precautions, you will probably sleep very shallowly and fitfully during night and you will eventually become wide awake sometime before the alarm clock goes off.

This reflects an elevated level of activity in the autonomic nervous system, preparing you to wake up on time and be ready for immediate action, in order not to miss the plane. Imagine having to repeat this scenario on a daily basis moving from one city

to another, catching early morning planes. Going to bed early does not result in improving the quality of your sleep which will still be fitful and disturbed. Similarly tinnitus, inducing even mild activation of the autonomic nervous system promotes a prolonged “catch the morning plane” situation and might profoundly affect your sleep patterns.

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