4

Tinnitus School – An Integrated Management of Somatic Tinnitus

D. Alpini[1] A. Cesarani[2] and A. Hahn[3]
[1]*Sc. Institute S. Maria Nascente, "Don Carlo Gnocchi" Foundation, Milan,*
[2]*Audiology Institute University of Milan, Milan,*
[3]*ENT Clinic, 3rd Medical Faculty, Charles University Prague, Prague,*
[1,2]*Italy*
[3]*Czech Republic*

1. Introduction

Epidemiological data suggest that tinnitus is something more and something different from an auditory symptom. In fact, subjective tinnitus is reported to be present in 10-15% (Axelson et. al 1995) persons in general population but it represents a medical problem, that interferes with general and emotional health state, only about 2%. Furthermore, factors associated with tinnitus such as hearing loss, hypertension, hormonal disorders, anxiety, depression are more frequent than tinnitus itself. (Sindhusake et al. 2004)

Stress is known to be a significant factor influencing the clinical course of tinnitus. Auditory system is in fact particularly sensitive to the effects of different stress factors (chemical, oxidative, emotional, …). Horner in 2003 described different stages of auditory pathways reacting to stress: alarm, resistance and exhaustion. Individual characteristics of stress reaction may explain different aspects of tinnitus in various patients with different responses to treatment, despite similar audiological and aetiological factors. A model based on individual reactions to stress factors (Stress Reaction Tinnitus - SRT -Model) could explain tinnitus as an alarm signal. In 2007 Alpini et al. described a therapeutic proposal based on SRT Model, through an integrated approach to the management of patients suffering from chronic tinnitus. The educational aspect was emphasized and therefore the approach was named Tinnitus School, that is a three-phases program (counselling, training, home training) mainly based on fitted physiotherapeutic protocol.

The usefulness of physical exercises in Tinnitus patients for reducing the emotional arousal that is underlined by different Authors, e.g ranging from Dehler et al. (2000) to Biesenger et al. (2010), but, in our experience, fitted physical activity could be the specific treatment of Somatic Tinnitus.

Somatic tinnitus regards a sub-group of tinnitus suffers. It is defined as tinnitus which is associated to a somatic disorder involving the head and the neck. Dehmel et al. (2008) introduced the Somatic Tinnitus Syndrome (STS). They presented the anatomical basis for the auditory-somatosensory interactions and showed how auditory neurons respond to somatosensory stimulation. Particularly, muscle--skeletal system could be a chronic stress source. In this way muscle-skeletal disorders can pathologically integrate with auditory disturbances increasing tinnitus. In this way, Stress Reaction Tinnitus (SRT) model could be

implemented into Somatic Tinnitus Syndrome (STS) model and Tinnitus School can act through fitted physiotherapy aimed to a patient-oriented treatment of selected tinnitus patients.

2. Tinnitus school in somatic tinnitus treatment

2.1 Stress reaction tinnitus model

In short-term stress reaction, hypothalamus plays an essential role in the integration of stress responses (alarm phase) through the connection between brainstem and spinal cord sympathetic and parasympathetic centres. In long-term stress, the same activation can be damaging via the prolonged secretion of stress hormones (exhaustion phase). Individual characteristics of stress reaction may explain different aspects of tinnitus in different patients, and different responses to treatment, despite similar audiological and aetiological factors.

For severe disabling chronic tinnitus, Shulman in 1995 and 2002 demonstrated that a final common pathway exists in the medial temporal lobe system, being its basic process the establishment of a paradoxical auditory memory. He proposed a model for tinnitus in which the final common pathway involves hippocampus and cerebellum providing the neurochemical basis (hippocampus) and the cognitive and motor basis (cerebellum) of behavioural aspects of tinnitus. Furthermore, Zenner & Zalaman in 2004 showed that in chronic tinnitus patients attention is pathologically shifted toward tinnitus and, in this way, cognitive functions are disturbed. The importance of limbic-auditory interaction in Tinnitus generation have been highlighted by Rauschercker at al (2010). According to the Authors limbic and auditory brain areas interact at the thalamic level and tinnitus can be tuned out by feedback connections from limbic regions which block the tinnitus signal from reaching auditory cortex. If the limbic region is dysfunctional because of chronic overloading stress (emotional tagging), this “noise- cancellation” mechanism breaks down and chronic severe disabling tinnitus results

In SRT model tinnitus may become an alarm signal, just like an “alarm bell”, at least at its onset (Alpini & Cesarani, 2006); tinnitus could become a disabling symptom only in subjects chronically exposed to stress factors which are unable to switch off the alarm signal and to counteract the effect of the stressors. Individual ability to counteract stress factors is in fact strictly specific for each subject: this means that the evolution from alarm to exhaustion is specific for each patient. Therefore, the definition of “acute” or “chronic” tinnitus cannot be referred to a standardized time period but has to be fitted to each subject: generally speaking, acute tinnitus may be correlated to the stress alarm phase, chronic tinnitus to the resistance stress phase, and chronic severe disabling tinnitus may correspond to the exhaustion phase. According to this model, stress signals of a specific patient have to be identified during the “alarm” phase in order to prevent an evolution toward a resistance phase and, especially, an exhaustion phase. These phases lead to chronic disabling tinnitus in which the emotional-affective activation is dominant.

In 2011 Bergado et al. proposed the 'emotional tag' concept, according to which the activation of the amygdala by emotionality would result in the modulation of neural plasticity in brain regions (e.g. hippocampus) involved in shaping memory of the emotional event. The 'synaptic tag' model explain the specificity of synaptic plasticity and it could represent the effects of the 'emotional tag' on synaptic plasticity in the hippocampus. In Somatic Tinnitus factors such as intensity, duration of sensory-motor distress and controllability of the emotional experience, age of exposure should be taken into account.

These factors do not only affect the behavioural outcome of the stressful experience but also find their expression in varieties in the neuronal and biochemical pathways that are activated, and in the way those will interact with memory formation mechanisms leading to the "paradoxical auditory memory"(Cluny et al 2004). In this way, the removal of stress factors is necessary for general health condition and is the prerequisite to cognitive-behaviour treatments (CBT). CBT is proposed in order to promote behavioural re-organization helping the patient to cope with tinnitus, according to the view that tinnitus is a systemic problem stemming from imbalance in the excitatory and inhibitory inputs to auditory neurons (Kaltenbach, 2010, Vanneste et al. 2010).
We combine accurate anamnesis and Feldman masking test (1971) with psychometric questionnaires in order to determine the individual phase of stress reaction. In our experience the Tinnitus Reaction Questionnaire (TRQ, Wilson et al. 1991) is useful to identify the stress phase (acute, resistance, exhaustion) of a specific patient. TRQ is a self-reported scale designed to assess perceived distress associated with tinnitus. It is composed of 26 items describing some of the potential effects of tinnitus on lifestyle, general well-being, and emotional state. Respondents are asked to rate the extent to which each of the potential effects have applied to them over the last week on a 5 point scale (0: not at all; 4: almost all the time). Respondents are also asked to indicate how frequently tinnitus induces some reactions such as depression, anger, confusion (from not at all to always). The total score ranges from 0 to 104. A lower score represents slight reaction to tinnitus (alarm) while higher scores indicate deeply negative reaction (exhaustion).
Regarding stressor identification we adopted a modified CAPPE questionnaire (Nodar, 1996) combined with an accurate evaluation of patient general medical documentation. CAPPE questionnaire investigates the presence of different kind of stressors: Chemical (prolonged expositions to solvents, assumptions of ototoxic drugs), Acoustic (noise exposure, acoustic neuroma, otosclerosis, hearing loss), Pathologies (diabetes, thyroiditis, autoimmune diseases), Physical (professional stress, worsening of tinnitus during physical exercises), and Emotional (sleep disorders, job change, depression).

2.1.1 Tinnitus as a motor system alarm

Somatic Tinnitus occurs when the patient feels the effect of head and neck muscle contractions on changing the intensity of the quality of tinnitus, for instance during clenching the teeth or head rotation. In these cases, tinnitus is modulated by stimuli of the somatosensory system as a result of muscle contractions. This is not surprising because the auditory system is part of the most complex sensory-motor system involved in the head position regulation, necessary to provide gravitation reference, prerequisite for a correct orientation of the human subject in the environment. The brainstem and cerebellum are the main sites of integration of multi-sensorial information from the inner ear, retina and proprioceptors regarding head position, body position, gravity, visual landmarks and movement of the jaw, the tongue, and the pharynx. (Simmons et al 2008, Norena, 2010). In a simple experiment Jousmäki and Hari (1998) described how auditory input can modulate or even determine the touch sensation. Subjects were asked to rub their hands and the thereby evoked sounds were played back to them. When the high frequency content of the played back signals increased, the subjects felt the skin on their palms becoming dry as parchment paper. This so called parchment-skin illusion is an impressive example of auditory-somatosensory integration. The converse was shown by Levine et al. (2007): forceful manipulations or contractions of the muscles of jaw, head or neck elicited the perception in

58% of the subjects. Several studies have demonstrated the interactions between the somatosensory and auditory system at the dorsal cochlear nucleus (DCN) (Tyler et al. 2008, Vanneste et al 2010, Yang et al. 2010), inferior colliculus, and parietal association areas. In particular, auditory and somatosensory (proprioceptive and tactile) pathways converge into specialized multisensory brain areas, particularly right inferior frontal gyrus and both right and left insula, that work as multisensory operators for the processing of stimulus identity (Renier et al. 2009).

2.2 Tinnitus school

Tinnitus School is aimed to promote behavioural re-organization by helping the patient to cope with tinnitus decreasing paradoxical memory and improving diversion and distraction of auditory attention. The organization model of Tinnitus School, physical exercise integrated in an educational program, is like to that of the well-known Back School (Tavafina et al. 2007). Treatment is based on three phases: Counselling, Training, Home Training. In somatic tinnitus treatment, Tinnitus School is especially paid to sensory-motor system through three steps of treatment:

1. removing cervico-cephalic sensory-motor disturbances, by means of Manual Medicine techniques (Maigne & Nieves, 2005)
2. leading the patient to an awareness of his/her own body and learning breath and neck tension control, through physical exercises
3. shifting patient attention away from tinnitus, thorough home physical exercises

2.2.1 Counselling

Counselling is carried out by the physician who visited the patient and prepared the treatment planning. Firstly the physician explains the main aspects of the Auditory system stressing patient attention to the phenomena involved in chronic tinnitus: paradoxical auditory memory and pathological attention to tinnitus. Lifestyle and drug assumption are investigated in order to identify specific stress factors and possibilities of changing are discussed with the patient. Perceived stress was quantified through Perceived Stress Questionnaire (PSQ) (Fliege et al. 2005). It is designed to represent the subjective perspective of the individual ("You feel... "). Because stress results from overload of experienced unpredictability and uncontrollability of events, the existence of stress in a subject is partially inferred from information on the person's experience of lack of control. The presented stress experiences in PSQ were intended to be abstract enough to be applicable to adults of any age, stage of life, sex, or occupation, but at the same time interpretable as specific to a variety of real-life situations. For example, "you feel under pressure from deadlines" could refer to anything ranging from a payment, to an oncoming birthday party, or to a grant proposal. This questionnaire asks the respondent how often does certain experiences of stress occurred in the last month. The content of the items is not referred to tinnitus but it focuses on a more cognitive appraisal of stress. PSQ is a 20-item questionnaire of 4 scales with 5 items each resulted:

- Scale 1 (worries) covers worries, anxious concerns for the future, and feelings of desperation and frustration (e.g “you have many worries”)
- Scale 2 (tension) explores tense disquietude, exhaustion, and the lack of relaxation (e.g. “you feel mentally exhausted”)

- Scale 3 (joy) is concerned with positive feelings of challenge, joy, energy, and security (e.g." you are full of energy") .
- Scale 4 (demands) covers perceived environmental demands, such as lack of time, pressure, and overload (e.g "you feel you are in a hurry") .

  Each positive (Yes) answer to scales 1-2-4 is scored 1. Joy scale is score 1 for each negative (No) answer because all items of this scale are positively worded. Thus maximum possible score, that to say the most unbearable stress perception, is 20 : the higher the total score is, the higher the perceived stress.

During Counselling phase the physician performs an accurate evaluation of posture, temporo-mandibular joints (TMJs) (Riga M et al, 2010) and cervical spine, in order to remove the main somatosensorial trigger and tender points in the cervico-cephalic district that can be interpreted as connected to chronic tinnitus generation.

Trigger points are described as hyperirritable spots in skeletal muscle that are associated with palpable nodules in taut bands of muscle fibres. Trigger points are small contraction knots and a common cause of pain. Compression of a trigger point may elicit local tenderness, referred pain, or local twitch response. It is common to induce transient tinnitus when stimulating trigger points in trapezius muscle. More specifically, somatic tinnitus suffers frequently present modulation of their spontaneous tinnitus during appropriate stimulation of trigger points in cervical and shoulder muscles. A tender point hurts to the touch and causes some degree of pain in that area, while a trigger point may not necessarily be painful to the touch but causes a degree of pain (or tinnitus in this specific field of investigation) to be felt in another area.

Manual Medicine treatment of tinnitus suffering is thus integrated with physical exercises of the Tinnitus School program, including also High Velocity Low Amplitude vertebral manipulations, directly performed by the physician.

Counselling is completed by modified bibliotherapy. Self-help books exist for a wide variety of psychological problems. Studies of their value indicate that they can help individuals to make substantial improvements (Malouff et al. 2010), on average about as much as psychotherapy. We propose to our patient selected Italian translated lectures from "Tinnitus: A Self-Management Guide for the Ringing in Your Ears". This self-help book by Henry & Wilson (2001) is based on cognitive–behavioural principles, including educational information on tinnitus, cognitive reappraisal and restructuring, relaxation and stress management techniques, attention control techniques, use of self-instruction, making lifestyle changes, and maintaining gains.

2.2.2 Training

Training is performed by a physiotherapist, in a gymnasium, in a small class of patients (3 subjects). Class treatment improve comparison and cooperation between patients and improve positive enforcement.

Tinnitus School is constituted by ten sessions subdivided into three sessions per week along two weeks followed by two sessions per week along two other weeks.

The first step is to prepare the patient to cooperate in a complex program involving movement, thinking and learning. Muscle-skeletal impairments are often provoked or associated to tension and anxiety, that is why head and neck disorders have to be treated before training. Furthermore, it is more necessary to begin treatment with simple relaxation exercises. (Weber et al. 2002) to manage patient's tension.

Physical Exercises are pointed to postural control because, in chronic somatic Tinnitus the abnormal alignment of body parts with respect to each other and to the base of support may be due both to musculoskeletal cervico-cephalic impairments and changes in patient's internal perception of the own sensations induced by pathological attention to tinnitus.
Simple exercises have to be planned and they are generally pointed to mobilization of the pelvis, of the cervical rachis and the thoraco-lumbar spine. In some cases massages can be useful either to relax the patient or to mobilize joints, including Slow Velocity High Amplitude vertebral manipulations performed by the physiotherapist.

Tinnitus school gymnasium training protocol

Supine (all the exercise are performed having patients' head comfortably lying on a pillow)

- Relaxation exercises with control of breathing improving consciousness of abdominal or thorax breathing: deep inhaling followed, after few seconds, by a forced exhaling pronouncing the word "one". This exercises is repeated 8-10 times
- Patients move the head, first slowly and then faster, in all directions focusing a target straight on the ceiling
- Patients take the right knee against the chest, then extend the leg and take the left knee against the chest. A gentle traction of the flexed knee is performed by patient himself when the knee is taken against the chest
- Patients take both knees to the chest, contemporarily, helping, gently, with the hands
- Patients lift pelvis taking contemporarily the arms extended over the head. Then patients re-take arms along the body lowering the pelvis
- Patients grasp a stick. Then they extend the arms over the head and then return in primary position
- In the quadrupedal position, patients inhale and arch the back taking the head between the arms. Then they exhale while retro-flexing the head and rotating the pelvis in hyperlordosis
- In quadrupedal position, patients extend contemporary the right arm and the left leg. Then repeat with the left arm and the right leg
- In prone position, patients lift their left arm and the right leg maintaining the forehead over the bed. Then they repeat with the right arm and the left leg

Sitting

- Patients move the head first slowly and then faster in all directions focusing on a target straight in front
- Patients look to for three targets sited, respectively, in front, at their left and at their right. Then patients focus on the front target, then they move the head focusing on the right-sited target. At last they rotate leftward the head maintaining the focus on the right-sited target
- Patients focus on the frontal target. Then they move the head leftward and focus on the left-sited target. At last they rotate rightward the head maintaining the focus on the left-sited target
- Patients turn the head rightward and focus on a target on the lateral wall. Then they take the head straight maintaining focusing, through eyes counter-rotation, and count until 10
- Patients turn the head leftward and focus on a target on the lateral wall. Then they take the head straight maintaining focus on the target, through eyes counter-rotation, and count until 10

- Patients extend the right arm and lift their thumb. Thus patients move slowly the arm to-and-from before along an horizontal direction and then along a vertical direction. Patients pursuit the thumb with eyes only, first slowly and then increasing progressively the velocity of thumb displacement
- As above but moving contemporarily also the head trying to maintain the eyes still
- Patients grasp a stick with both hands and take the stick behind the shoulder positioning the stick at level of cervico-dorsal junction. In this position they rotate to-and-fro the trunk maintaining the head still also focusing on a target straight in front. Rotation of the trunk have to be harmonic with quiet breathing
- Patients put the stick forward on the sternum at the level of the sterno-clavear joint. Then they perform rhythmic backward displacements of shoulders
- In this position they rotate to-and-fro the trunk maintaining the head still also through fixation of a target straight in front. Rotation of the trunk have to be harmonic with quiet breathing
- Paying attention to quiet breathing patients inspire. Then, exhaling, they bend forward taking the head on the right knee. They wait 10 seconds. Then, inhaling they return in sitting position.
- Paying attention to quiet breathing patients inspire. Then, exhaling they bend forward taking the head on the left knee. They wait 10 seconds. Then, inhaling they return in sitting position.
- Patients Inhale. Exhaling they bend forward to keep an object on the floor. Then they inhale and take it up over the head and then they fixate it for 10 seconds. Patients inhale. Exhaling they bend forward and take the object on the floor

Standing

- Patients focus themselves on a mirror and align correctly their posture. Thus they maintain quiet equilibrium for 1 minute, paying attention to breathing; at first they maintain eyes open and successively they close the eyes imagining the correct position in their mind. They remain in this position for at least 1 minute paying attention to breathing. Then they oscillate to-and-fro according to the breath rhythm, hearing the air that enter and then exits from the lungs
- Patients in quiet upright position fixate a target on a mirror. In this case they have two planes of fixation: the target and their image. Thus they have to be able to extract the correct fixation information from visual inputs. Then they oscillate to-and-fro according to the breath rhythm hearing the air that enter and then exits from the lungs
- Patients keep a little object and lift it over the head fixating it. Then they deeply inspire. Expiring, they bend forward taking the object on the floor. They wait 10 seconds and then, inspiring, they lift again the object over the head
- Patients take a little object over their head. Fixating the object they move it in small circles according to breath rhythm hearing the air that enter and then exits from the lungs

2.1.3 Home training

As in every "school" , home training is as important as class training. A part of gymnasium session is dedicated to instruct patients how to correctly perform home exercises. Home protocol is showed in Tab II. Exercises have to be performed every day twice a day.

Tinnitus school home training protocol

Supine

- Relaxation exercises with control of breathing, improving consciousness of abdominal or thorax breathing: deep inhale followed, after few seconds, by a forced exhale pronouncing the word "one". This exercises is repeated 8-10 times
- Take your two knees to the chest, contemporary, helping, gently, with the hands
- Lift your pelvis taking contemporary your arms extended over your head. Then re-take your arms along the body lowering your pelvis
- Grasp a stick. Take your extended arms over your head and then return in primary position
- In prone position lift your left arm and the right leg maintaining your forehead over the bed. Then repeat with the right arm and the left leg.

Sitting

- Move your head first slowly and then faster in all directions focusing on a target straight in front of you
- Grasp a stick with both hands and take the stick behind the shoulder positioning the stick at the level of the cervico-dorsal junction. In this position rotate to-and-fro the trunk maintaining the head still also through fixation of a target straight in front. Rotation of the trunk have to be harmonic with quiet breathing
- Repeat the exercise putting the stick forward on the sternum at the level of the sterno-clavear joint. Then perform rhythmic backward displacements of shoulders

Standing

- With your hands on a table, lift yourself on your tiptoes, maintain this position for 30 seconds. Pay attention to breathing!
- With your hands on a table, lift yourself on your heels, maintain this position for 30 seconds. Pay attention to breathing!
- Focus yourself on a mirror. Then oscillate to-and-fro, right-and-left, around your ankles keeping your pelvis still, according to breath rhythm hearing the air that enters and then exits from the lungs
- Repeat with eyes closed.
- Keep a little object and then lift it over your head and focus on it. With your extended arms move it with over and over wide circles maintaining focus on the object, according to the breath rhythm hearing the air that enter and then exits from the lungs
- Repeat with eyes closed. . Pay attention to breathing!
- Keep a little object and lift it over your head. Focus on it. Inhale. Then exhale and bend yourself forward taking the object on the floor. Wait 10 seconds and then inhaling lift again the object over your head. Pay attention to breathing!

2.3 Selection of the patients

Selection of the patients was based on a complete audiological, muscle-skeletal and stress balance (CAPPE questionnaire and PSQ).

The inclusion criteria are:

1. Acute or Chronic Tinnitus in alarm or resistance stress reaction phase: TRQ less than 80
2. CAPPE 's item "increasing with physical exercise" positive answer

3. PSQ score at least 15 as total score OR 4-5 score in "tension" sub-scale
4. Patient's tinnitus modulated by somatic manoeuvres as described by Levine et al. 2007
5. No tinnitus modulation t by Jendrassik manoeuvres. In our experience modulation by clenching, neck forceful flexion,… AND Jendrassik modulation means a no-specific facilitation of tinnitus perception to be distinguished from specific, treatable, somatic involvement
6. Trigger or tender point in the muscles specifically activated during forceful somatic manoeuvres, e.g masseter or anterior temporal regarding clenching, sterno-cleido-mastoideus regarding neck flexion or rotation, and so on

To determine individual Tinnitus specific reaction beside TRQ , Tinnitus Cognitive Questionnaire (TCQ) (Wilson &Henry 1998) was adopted. TCQ investigates patient approach to tinnitus with 13 negative (1-13) and 13 positive (14-26) thinking items, rated on a 0 - 4 point scale. For each item, respondents are asked to "indicate how often they have been aware of thinking a particular thought on occasions when they have noticed the tinnitus". The negative items are scored from 0 to 4 whereas the positive items are scored from 4 to 0. The total score is the sum of the scores of each item and ranges from 0 to 104. A high score represents a greater tendency to engage in negative cognitions in response to tinnitus and low engagement in positive cognitions.

TRQ, PSQ and TCQ represent the outcome measures of Tinnitus School Treatment. TRQ and PSQ are administered by the physician during selection/counselling while TCQ is administered by the physiotherapist at the first training session.

No specific drug was proposed but only those necessary for general health treatment (diabetes, hypertension,…) even through combined physical and pharmacological treatment has been proposed by Hahn et al. (2007).

Patients were controlled each month for 3 months and, successively, after six months, in order to modify home training exercises planning and to re-motivate them to therapy.

3. Conclusion

Tinnitus is a symptom that it is not possible to solve when it is chronic. Chronic disabling tinnitus is due to emotional-affective involvement induced by a pathological shift of patient attention to his/her tinnitus. Coping with tinnitus thus require a modification of the patient approach to inself perception through the modification of lifestyle, stressor removing, and diverting pathological attention. The aim of the tinnitus cure, generally speaking, is to reach a golden point in which patient is able to hear tinnitus but tinnitus is not disabling for the patient.

Tinnitus School is an educational approach aimed to help the patient to manage her/his symptom in order to restore a normal quality of life.

Tinnitus School, especially when it regards somatic subtype, requires both strict cooperation between the Physician and the Physiotherapist and as well that Physician is well trained in diagnosis and treatment of muscle-skeletal disturbances of head and neck.

According to the strict selection criteria adopted, we treated 24 patients, in 8 classes (6 males and 18 females, mean age 51,5 years old; TRQ 67 ± 7; TCQ 74 ± 6). No specific drugs were proposed. Regarding PSQ, mean total score was 17±2 and all the patients presented maximum tension sub-scale score.

All the patients were controlled each month for 3 months. In all of them tinnitus coping was referred to be good, with a positive increase of quality of life, documented by a decrease of

TRQ and TCQ scores, respectively to 38 ± 9 and 34 ± 4, as showed in fig.1.After six months, 18 patients were controlled (6 dropped out), but all maintained life-style modifications (sleep and diet regulation, regular physical exercise) with satisfying tinnitus coping.

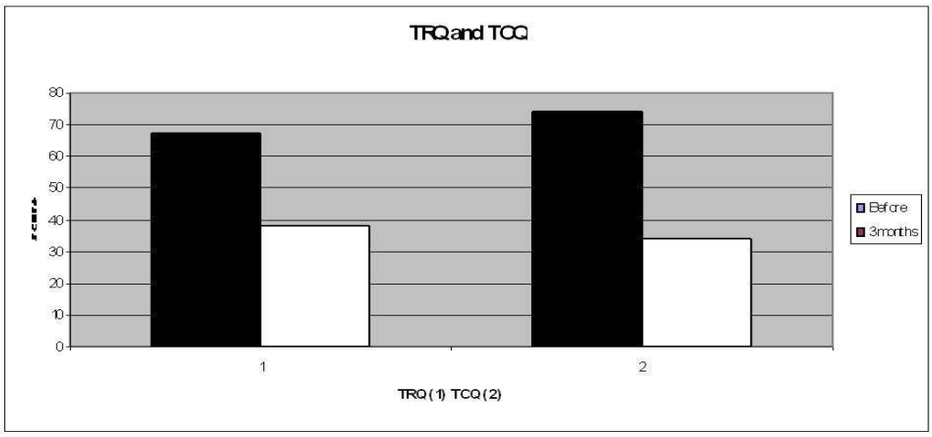


Fig. 1. TRQ and TCQ modifications after 3 months follow-up (mean values). Both reaction questionnaire and cognitive questionnaire scores are reduced, representing a positive increase of quality of life.

Follow-up2 PSQ re-scoring showed significant improvements for two of the stress scales and the overall score: After 10 sessions of training and three months of home training tinnitus patients showed a significant decrease of generally PSQ score, that to say generally perceived stress level, amelioration regards tension decrease (less positive answers) and joy increase (less negative answers), worries and demands remain unchanged, as already described by Weber et al. (2002). (Fig.2)

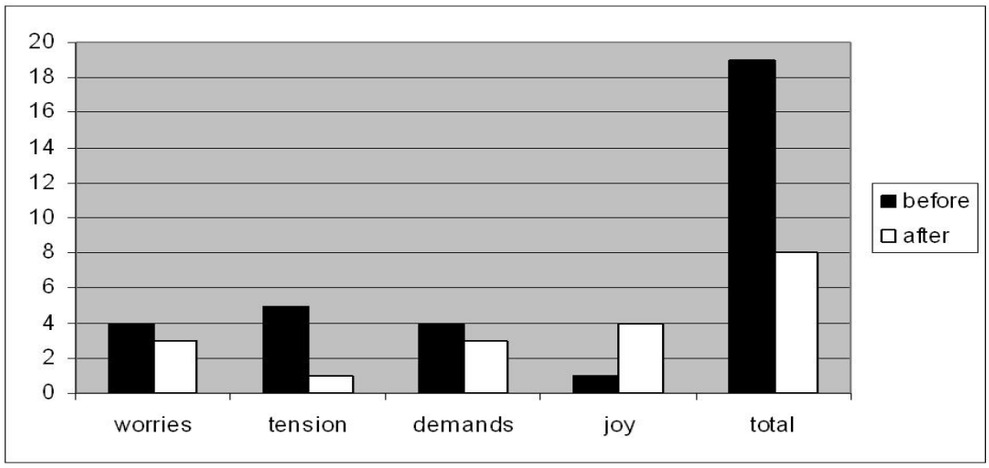


Fig. 2. PSQ mean subscales and total scores are showed (mean values). Scores regard pre-treatment and after 3-months follow-up. Worries and Demands subscales didn't n modify while tension and joy sub-scales ameliorated. Thus the total score is decreased after Tinnitus School program. Joy is presented in a reverse way with respect to the questionnaire in order to better represent the positive modifications.

Decreasing TCQ, TRQ and PSQ scores represent a significant improvement in the quality of life of the participants, suggesting therefore that educational approach could have an effect on the cognitive aspects of tinnitus and contributes positively to the management of tinnitus. Anyway, six month drop-out regarded 25% of the patients and this highlight how is difficult to maintain motivation to perform constantly home exercises.

Generally, evaluating the adopted psychometrics questionnaires, Tinnitus School program resulted in a significantly decrease of tinnitus disturbance (TRQ and TCQ) through a decreased perception of stress (PSQ) but it requires both a strict selection of the subjects and patients strongly motivated "to feel better"; furthermore adequate complete treatment of cervico-cephalic somatosensory disturbances is needed.

Further researches have to be pointed both to a better understanding of the basis of neurobiological connection between sound and motion and a better selection of somatic tinnitus sub-type patients. In fact, Tinnitus may represents a sort of auditory after-effect (Riecke et al 2011): an interrupted sound can be perceived as continuous when noise masks the interruption, creating an illusion of continuity. Recent findings have shown that adaptor sounds preceding an ambiguous target sound can influence the listeners' rating of target continuity. However, it remains unclear whether these aftereffects on perceived continuity influence sensory processes, decisional processes (i.e., criterion shifts), or both. It is reasonable to assume that somatic disturbances convey abnormal inputs on DCN creating something like spinal segmental sensitization described by Fisher (1997) to explain chronic myofascial pain. According to this idea, somatic inputs may represent the "sensorial noise" in the DCN that masks the interruption, creating an illusion of continuity, continuity that we know to be the prerequisite for inducing chronic Tinnitus at both cortical and limbic level.

4. Acknowledgment

We thanks Mrs Nayera Saad for checking the English translation; we are indebted with dott. Giampaolo De Sena that suggested to us spinal segmental sensitization model as a somatic tinnitus model and consequently with prof. Guido Brugnoni that introduced us in adopting Manual Medicine for somatic tinnitus diagnosis and treatment

5. References

Alpini, D. Cesarani, A. (2006) Tinnitus as an alarm bell: stress reaction tinnitus model. *ORL J Otorhinolaryngol Relat Spec.* Vol. 68(1), 31-6

Alpini, D. Cesarani, A. Hahn, A. (2007) Tinnitus school: an educational approach to tinnitus management based on a stress-reaction tinnitus model. *Int Tinnitus J.* Vol.13(1),63-68

Axelsson, A. Ringdahl, A. (1985) Tinnitus: a study of its prevalence and characteristics. *British J Audiol* Vol. 23. 53-62.

Bergado, JA. Lucas, M. Richter-Levin, G. (2011) Emotional tagging-A simple hypothesis in a complex reality. *Prog Neurobiol*. Vol.94(1).64-76

Biesinger, E. Kipman, U. Schatz, S. Langguth, B. (2010) Qigong for the treatment of tinnitus: a prospective randomized controlled study.*J psycosom Res* Vol. 69 (3). 299-304

Cluny, C. Norena, A. El Massioui, F, Chery-Croze, S. (2004) Reduced attention shift in response to auditory changes in subjects with tinnitus. *Audiol Neurootol* Vol.9. 294-202

Dehler, R. Dehler, F. Claussen, CF. Schneider, D. Just, E. (2000) Competitive-kinesthesic interaction therapy. *Int* Tinnitus J Vol. 6(1): 29-35

Dehmel, S .Cui, Y.L. Shore, S.E. (2008) Cross-modal interactions of auditory and somatic inputs in the brainstem and midbrain and their imbalance in tinnitus and deafness *Am J Audiol* Vol.17(2): 193–209

Feldman, H. Homolateral and contralateral masking of tinnitus by noise-bands and by pure tones. (1971) *Audiology* Vol.10(3):138–144.

Fliege, H. Rose, M. Arck, P. Walter ,O.B. Kocalevent,R.D., Weber, C. Klapp, B.F.The Perceived Stress Questionnaire (PSQ) reconsidered: validation and reference values from different clinical and healthy adult samples. (205) *Psychosom Med*. Vol.67(1):78-88

Fischer, A.A. (ed) Myofascial pain-Update in Diagnosis and Treatment. Phys Med Rehabil Clin North Am, Philadelphia, W.B. Saunders, 1997; p.153-169.

Hahn, A. Sejna, I,.Stolbova, K. Cocek, A. Combined laser-EGb 761 tinnitus therapy. (2001) *Acta Otolaryngol* Suppl.545:92-93.

Henry, J.L. Wilson, P.H. Tinnitus: a self-management guide for the ringing in your ears. Boston: Allyn and Bacon, 2001.

Horner, K.C. The emotional ear in stress. (2003) *Neusorscience Behav Rev* Vol.27: 437-446

Jousmäki and Hari (1998) Parchment-skin illusion: sound-biased touch. (1998) *Curr Biol*. Vol.12;8(6): 190-195

Kaltenbach, J.A. Tinnitus. Models and Mechanisms. (2010) *Hear Res* Vol.10(1):35-38

Levine, R.A Nam, E.C. Oron, Y. Melcher, J.R. Evidence for a Tinnitus subgroup responsive to somatosensory based treatment modalities. (2007) *Progress Brain Research* Vol 166: 195- 207

Malouff, J.J. Noble, W. Schutte, N.S Bhullar, N. The effectiveness of bibliotherapy in alleviating tinnitus-related distress (2010) *Journal of Psychosomatic Research* Vol.68 (2):245–251

Maigne, R. & Nieves, W.L. Diagnosis and Treatment of Pain of Vertebral Origin, Second Edition (Pain Management) Informa Healthcare - 568 pages, 2 edition 2005

Nodar, R.H. CAPPE - A strategy for counselling tinnitus patients. (1996) *Int Tinnitus J* Vol. 2(2): 111-114

Norena, A. J. An integrative model of tinnitus based on a central gain controlling neural sensitivity. (2010) *Neuroscience and Biobehavioral Reviews* Vol.10: 345-353

Rauschecker, J.P. Leaver, A.M. Muhlau, M. Tuning Out the Noise: Limbic-Auditory Interactions in Tinnitus. (2010) *Neuron* Vol.66, (24): 819-826

Renier, L.A. Anurova, I. De Volder, A. G. Carlson ,S . VanMeter, J. Multisensory Integration of Sounds and Vibrotactile Stimuli in Processing Stream for "What" and "Where". (2009) *The J. Neurosc.* Vol. 29(35): 10950-10960

Riecke, L. Micheyl, C. Vanbussel, M. Schreiner, C.S. Mendelsohn, D. Formisano, E. Recalibration of the auditory continuity illusion: Sensory and decisional effects. (2011) *Hear Res*. Vol. 27: 765-771.

Riga, M. Xenellis, J. Peraki, E. Ferekidou, E. Korres, S. Aural Symptomps in Patients with Tempero-Mandibular Joint Disorders. Multiple Frequency Tympanometry Provides Objective Evidence of Charges in Middle Ear Impedence. (2010) *Otol Neurotol* Vol. 31:456-461

Shulman, A. A final common pathway for tinnitus: the medial temporal lobe system. (1995) *Int Tinnitus J* Vol.1: 115-126

Shulman, A. Strashun, A.M. Goldstein, B.A. GABA-benzodiazepine-chloride receptor-targeted therapy for tinnitus control: preliminary report. (2002) *Int Tinnitus J*. Vol.8(1):30-38

Simmons, R. Dambra, C. Lobarinas, E. Stocking, C. Salvi, R. Head, Neck, and Eye Movements That Modulate Tinnitus. (2008) *Semin Hear*. Vol.29(4): 361–370.

Sindhusake, D. Golding, M. Wigney,D. Newall, P. Jakobsen, K. Mitchell, P. Factors predicting severity of tinnitus: a population-based assessment. (2004) *J Am Acad Audiol* Vol.15(4): 269-280.

Tavafian, S.S. Jamshidi, A. Mohammad, K. Montazeri, A. Low back pain education and short term quality of life: a randomized trial. (2007*) BMC Musculoskelet Disord*. Vol. 28;8:21

Tyler, R. Coelho, C. Tao, P. Ji, H. Gehringer, A. Gogel, S. Identifying Tinnitus Subgroups With Cluster Analysis (2008) *Am J Audiol*. Vol. 17(2): 176–184

Vanneste,S. Plazier, M. Van de Heyning, P. De Ridder, D. Transcutaneous electrical nerve stimulation (TENS) of upper cervical nerve (C2) for the treatment of somatic tinnitus (2010) *Exp Brain Res* Vol.204:283–287

Vanneste, S. Plazier, M. van der Loo, E. Van de Heyning, P. Congedo, M. De Ridder, D. The Neural Correlates of Tiinnitus-related distress. (2010) *Neuroimage* Vol.52: 470-480

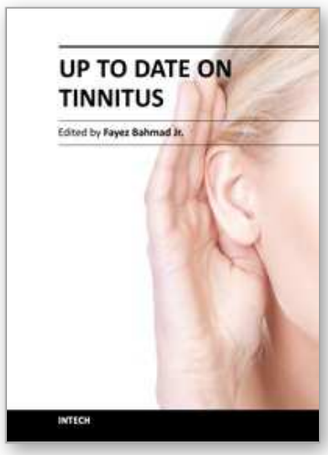
Yang, Q. Vernet, M. Orssaud, C. Bonfils, P. Londero, A. Central Crosstalk for Somatic Tinnitus: Abnormal Vergence Eye Movements. (2010) *PLoS ONE* Vol.5(7): 11845-11852

Weber ,C. Arck, P. Mazurek, B. Klapp, B.F. Impact of a relaxation training on psychometric and immunologic parameters in tinnitus sufferers. (2002) *Psychosom Res*. Vol.52(1):29-33

Wilson, P.H. Henry, J. Bowen, M. Haralambous, G. Tinnitus reaction questionnaire: psychometric properties of a measure of distress associated with tinnitus. (1991) *J Speech Hearing Res* Vol.34: 197-201

Wilson, P.H. Henry, J. Tinnitus cognitions questionnaire: development and psychometric properties of a measure of dysfunctional cognitions associated with tinnitus. (1998) *Int Tinnitus J* Vol.4(1): 23-30.

Zenner, H.P. Zalaman, I.M. Cognitive tinnitus sensitization: Behavioural and neurophysiological aspects of tinnitus centralization. (2004) *Acta Otolaryngol* Vol. 124(4):436–439



Up to Date on Tinnitus

Edited by Prof. Fayez Bahmad

ISBN 978-953-307-655-3
Hard cover, 186 pages
Publisher InTech
Published online 22, December, 2011
Published in print edition December, 2011

Up to Date on Tinnitus encompasses both theoretical background on the different forms of tinnitus and a detailed knowledge on state-of-the-art treatment for tinnitus, written for clinicians by clinicians and researchers. Realizing the complexity of tinnitus has highlighted the importance of interdisciplinary research. Therefore, all the authors contributing to the this book were chosen from many specialties of medicine including surgery, psychology, and neuroscience, and came from diverse areas of expertise, such as Neurology, Otolaryngology, Psychiatry, Clinical and Experimental Psychology and Dentistry.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

D. Alpini A. Cesarani and A. Hahn (2011). Tinnitus School – An Integrated Management of Somatic Tinnitus, Up to Date on Tinnitus, Prof. Fayez Bahmad (Ed.), ISBN: 978-953-307-655-3, InTech, Available from: http://www.intechopen.com/books/up-to-date-on-tinnitus/tinnitus-school-an-integrated-management-of-somatic-tinnitus

INTECH
open science | open minds

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

IntechOpen