WIDEX **ZEN** THERAPY

MANAGING THE EFFECTS OF TINNITUS

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HIGH DEFINITION HEARING

WIDEX ZEN THERAPY
MANAGING THE EFFECTS OF TINNITUS

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DISCLAIMER

The Widex Zen Therapy protocol is Widex's attempt to provide systematic guidelines for clinicians to manage people with tinnitus. It is based on Dr. Robert Sweetow's expertise and our cumulative research findings on the use of Zen. It is not intended to be a substitute for individual medical advice, diagnosis, or treatment by a physician or any healthcare professional who is aware of the person's medical history. It is important that the person consult with a physician (preferably an ENT) to rule out any medical treatable conditions before starting the Widex Zen Therapy.

The individual person's response to the Widex Zen Therapy may vary. Some require all components of the protocol while others may only require one or two components. Furthermore, some will notice immediate benefits while others may require a month or so to start noticing improvement. If a person with tinnitus notices any significant worsening in hearing, tinnitus or ear-related medical conditions during the Widex Zen Therapy, s/he should discontinue the therapy (including using Zen or hearing aids) and be instructed to contact the healthcare professional immediately for appropriate resolution. Sometimes, referrals to other professionals may be necessary. The manual contains a list of certain "red flags" that identify the need for immediate referral to other professionals.

Widex Zen Therapy is developed by Widex A/S in co-operation with Dr. Robert Sweetow, Professor of Audiology, University of California, San Francisco

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WIDEX **ZEN THERAPY**

As both hearing loss and tinnitus are related to increased stress, Widex decided several years ago to introduce Zen fractal tones providing a relaxing auditory background into some of our hearing aids. Tinnitus is a symptom known to be highly correlated with stress; stress increases tinnitus handicap, and the negative reaction people have to tinnitus increases stress. Widex has therefore decided to take Zen a step further and develop a strategy that contains not only a superior hardware device, but also an educational, counseling, and training program. We recognize the need for this program to be comprehensive, dynamic, and reflect evolving changes in tinnitus research and technology. Therefore, we will provide materials not only for the advanced tinnitus practitioner, but also for the hearing care professional who doesn't have the time for extensive therapy.

Despite the lack of a tinnitus "cure", it is unethical and immoral to inform a person suffering from tinnitus that "there is nothing that can be done for you, just learn to live with it". Although not every hearing care professional will want to (or realistically, should) become immersed in comprehensive and detailed tinnitus management, all hearing care professionals owe it to the person with tinnitus and their profession to have a basic knowledge about the effects of tinnitus and how basic counseling techniques and simple acoustic therapies can minimize the negative impact tinnitus may have on people.

We hope you will find that the information contained within this manual will give you the ability to best help people with tinnitus.

PART **1**

INTRODUCTION

Millions of people around the world have tinnitus, but fortunately not every person requires extensive professional attention. In fact, it is typical for most people with tinnitus to note that over the first 6 to 12 months, their phantom percepts become softer and more familiar, so that they no longer command attention, thus becoming easier to ignore. So while the tinnitus and its perception may or may not have vanished, it becomes non-bothersome. Basically, these fortunate people have no negative reaction to tinnitus. These people may be simply helped with reassurance and, for those with hearing loss, with hearing aids.

However, there is a sizable segment of the tinnitus population for whom the negative reaction is sufficient to require professional intervention. The information contained in this manual is designed to help these people (although it will also be useful for reassuring the person with no negative reaction.) It should be noted from the outset that the Widex Zen Therapy is not a "cure" for tinnitus. Rather, it is a program designed to help people manage their reaction to this annoying symptom.

Widex Zen Therapy is unique because it is an integrated program addressing all three major components of tinnitus distress; auditory, attention, and emotion. While many persons with tinnitus will be adequately served by counseling and sound therapy (hearing aids with the fractal tone and noise options), those people who have increasingly significant negative reactions to their tinnitus will be best treated with a comprehensive program that integrates cognitive-behavioral concepts, relaxation exercises along with sleep management counseling and acoustic tools.

GENERAL DETAILS

It is very important for hearing care professionals to have a basic understanding of the details known about tinnitus. The following section provides information regarding some of the more important considerations.

How common is tinnitus?

- Approximately 15% of the world population has tinnitus.
- Most people report having experienced a "normal" tinnitus; namely transient (typically less than a minute) that disappears on its own.
- The majority of people with significant tinnitus report that it is constant, though many indicate that it fluctuates from day to day, or is influenced by many external factors, such as noise exposure, stress, fatigue, etc.
- On average, 10-20% of people with tinnitus seek medical help.
- Reports indicate that 70-90% of people suffering from tinnitus show some degree of hearing deficit when tested, yet nearly 60% deny hearing loss on self-report.
- The most common conditions associated with tinnitus are noise induced hearing loss, presbyacusis, and Ménière's syndrome.
- Men are more likely to report tinnitus than women.
- The incidence of tinnitus increases substantially with age.
- The prevalence (but not the loudness) of tinnitus is related to the severity of the hearing loss.

Tinnitus in children also occurs, but it is less commonly reported than in adults. This may be because a child with tinnitus considers the noise in the ear to be normal, as it has usually been present for a long time. It is also possible that children don't distinguish between the psychological impact of tinnitus and its medical significance and thus don't report it. The prevalence of pediatric tinnitus ranges between 3-42% and is higher in children with hearing loss.

What does tinnitus "sound" like?

Some people think tinnitus means "ringing in the ear". But in fact, ringing is only one of many phantom percepts people experience. Other commonly perceived tinnitus sounds include, but are not limited to, hissing, static, crickets, screeching, sirens, whooshing, roaring, pulsing, ocean waves, buzzing, and clicking, or dial tones. There are also some people who report hearing "music". This may be a form of auditory hallucination or related to an abnormal temporal lobe activity. These people are best referred to a physician or, in some cases, a psychiatrist.

What are the most common difficulties related to tinnitus?

- Sleep
- Difficulty concentrating
- Focusing on speech
- Anxiety
- Despair, frustration, depression
- Annoyance, irritation
- Stress

What causes tinnitus?

There are literally hundreds of etiologies associated with tinnitus, most, but not all, associated with hearing impairment. Among the causes of tinnitus (divided by anatomical location) are:

Outer and middle ear pathologies:

- cholesteatoma
- mastoiditis
- otosclerosis
- otitis media
- impacted cerumen
- allergies
- palatal myoclonus
- head/ear trauma
- patulous eustachian tube
- glomus jugulare tumor

Inner ear pathologies:

- presbyacusis
- acoustic trauma
- noise exposure
- Ménière's disease (endolymphatic hydrops)
- labyrinthitis
- hereditary inner ear disorders
- acoustic neuroma
- head/ear trauma
- ototoxicity

- meningitis
- perilymph fistula
- autoimmune inner ear disease
- vestibular schwannoma (acoustic neuroma)
- sudden hearing loss

Non-auditory related pathologies:
- vascular disorders
- cardiovascular disease/hypertension
- blood disease /anemia
- multiple sclerosis
- renal disease / Alport's / kidney transplants
- lyme disease
- zinc deficiency
- poor circulation
- hypothyroid/ hyperthyroid disorders
- high cholesterol
- hyperlipidemia

Somatic influences:
It has been observed that a person experiencing tinnitus can alter the perception by making changes in jaw position, eye gazing, and other physical movements. In addition, a number of somatic conditions have been identified both as a cause of, and as an exacerbating factor in, tinnitus. These include:

- temporomandibular (jaw joint) disorders
- cervical misalignment (neck dysfunction)
- constriction or narrowing of arteries in the neck

Diagnostic indications that may indicate somatic components include:
- intermittency
- large fluctuations in loudness
- variability of location
- head or neck trauma in absence of hearing loss

Drugs, medications and diet:
Many medications are associated with tinnitus. Some can produce tinnitus only while they are in the system (such as salicylates, like aspirin), while others can produce permanent tinnitus, such as from a potentially ototoxic antibiotic (such as gentamycin). In addition, many medications have interactions. Therefore, it is wise to view the list of medications the person takes, and if you have questions, consult a pharmacologist. You can obtain a free copy of the "PDR Guide to Drug Interactions, Side Effects, and Indications for Tinnitus," from national tinnitus organizations such as the American Tinnitus Association.

A partial list of the most commonly cited drugs that may exacerbate or cause either transient or permanent tinnitus include:
- salicylates, i.e. aspirin
- non-narcotic analgesics, i.e. ibuprofen or naproxyn
- ototoxic diuretics, i.e. furosemide (lasix)
- ototoxic antibiotics, i.e. gentamicin or erythromycin
- ototoxic chemotherapeutic agents, i.e. cisplatin

Less is known about diet and tinnitus, but it is wise to discuss diet with people with tinnitus to ensure that they are receiving a well-balanced diet. For example, people who may have Ménière's syndrome should be placed on a very restricted salt free diet. Advise them to speak with their physician. Caffeine, while not a direct cause of tinnitus, may create conditions (including anxiety) in some individuals that make it more difficult to cope with tinnitus. However, some people may find withdrawal from caffeine to be upsetting and stress inducing.

Other factors that may not cause tinnitus, but may exacerbate (or increase its perception) include:
- alcohol
- stress

While the underlying cause of tinnitus may exist for some time, it is common that there is an identifiable trigger or event that brings the tinnitus to the person's consciousness. These triggers may be from a change in physical status, such as a virus, infection, hearing status, change in weight, neck or back injury; or from a psychological event such as an increase in stress, job change, illness of a family member, financial worries, or divorce.

Which "red flags" suggest the need for immediate referral?

People suffering from tinnitus presenting with any of the following symptoms or diagnostic findings should be referred to a physician (particularly an otolaryngologist) before beginning Widex Zen Therapy because they may either be treatable or may indicate the presence of a serious medical condition:
- sudden hearing loss
- unexplained unilateral hearing loss
- pulsatile tinnitus
- tinnitus accompanied by dizziness or vertigo
- tinnitus with conductive hearing loss previously not diagnosed
- depression, anxiety, or uncontrolled and extreme stress

The physician's examination should consist of a comprehensive case history, a thorough physical examination of the ear and head, checking for signs of somatic and neurological involvement, appropriate lab tests for systemic illnesses, and, when appropriate, neuroimaging such as MRI, MRA, or CT scans.

Where is the tinnitus coming from?

There have been many theories regarding the generation of tinnitus. It is clear that regardless of the initial cause of the tinnitus, it is ultimately perceived and processed in the brain. We know this because if a surgeon severs the auditory nerve (thus breaking the connection between the cochlea and the brain), the person would definitely be deafened, but would still be likely to perceive the tinnitus.

The fact that most people with tinnitus also show at least some deficit in hearing leads to the speculation that tinnitus perception is related to auditory deprivation. It is believed that the central nervous system reacts to the lack of neural stimulation from the ear (phantom signal) by increasing its "attentiveness" to the auditory signals that do reach it, with consequent awareness of sounds arising from previously subconscious abnormal neural activity in the system. This happens in other parts of the body as well. For example, in the case of "phantom limb syndrome", a person who has had a leg amputated may perceive physical sensations from the missing limb. This occurs because the neurons and segments of the brain that are responsible for perceiving sensation from that limb are still intact and functioning, in spite of the fact that the limb is missing. The functioning neurons in the brain expect stimulation that they are not receiving, and so the brain essentially "turns up" its internal gain to detect stimulation and thus begins to receive stimulation that was previously undetected and reacts to other regions not previously associated with the missing limb. Similarly, with hearing loss, the neurons in the brain responsible for processing sound from the cochlea are still intact and functioning, but when they are deprived of receiving signals from the cochlea (due to hearing loss), they overcompensate by seeking out the missing stimulation and instead misperceive other electrical stimulation (that may previously have been ignored) as sound. This is one of the reasons why hearing aids providing amplification in the region of the hearing loss are so helpful. This will be explained in detail shortly.

While the auditory deprivation theory is the most logical (and simple) explanation to relate tinnitus with hearing loss, there are a number of more complex theories about tinnitus generation. Among them are:

- decrease in inhibitory (efferent) outer hair cell function
- over-representation of edge-frequencies (cortical plasticity)
- dysfunctional gating in basal ganglia or thalamic reticular nucleus
- input from somatosensory system (ephaptic transmission)
- abnormal rhythm or rate of spontaneous 8th nerve discharges
- alteration of homeostasis (ratio of mean to spontaneous firing rate)

In addition to these auditory and or neural based processes, activation of the limbic system due to association with fear and threat greatly contributes to increased stress, and tinnitus related anxiety. They also help create the attention and emotional issues which are important factors in tinnitus perception and distress. The limbic system (Figure 1) consists of a group of structures including the hippocampus which supports memory storage and retrieval, amygdala which supports emotional associations, and hypothalamus which instructs the release of neurotransmitters that impact the autonomic nervous system.

How is tinnitus classified?

Tinnitus is typically classified as subjective (meaning only the person can hear it) or objective, meaning an examiner can hear it (usually using a stethoscope).

Subjective tinnitus is found in over 95% of cases and is presently undetectable by measures other than by person report. In the vast majority of cases, subjective tinnitus cannot be cured (although there is a vast difference between "no cure" and "no help").

Objective tinnitus is uncommon and accounts for less than 5% of tinnitus cases. Causes of objective tinnitus are usually vascular or muscular. Objective tinnitus is often experienced as a pulsing sound (which coincides with the person's pulse), or a clicking sound. Vascular (pulsatile) tinnitus may be related to a compressed blood vessel or artery. Causes of muscular tinnitus include:

- contractions of tensor tympani or the nasopharyngeal muscles controlling the patency of the Eustachian tube
- palatal myoclonus (usually bilateral)
- stapedial muscle spasm
- autophony (echoing of the voice), or blowing tinnitus
- patulous (open) Eustachian tube (usually ipsilateral to ear having the tinnitus perception)

In certain cases, objective tinnitus can be visibly detected or confirmed by looking for synchronous deflections during impedance testing (for example, as seen

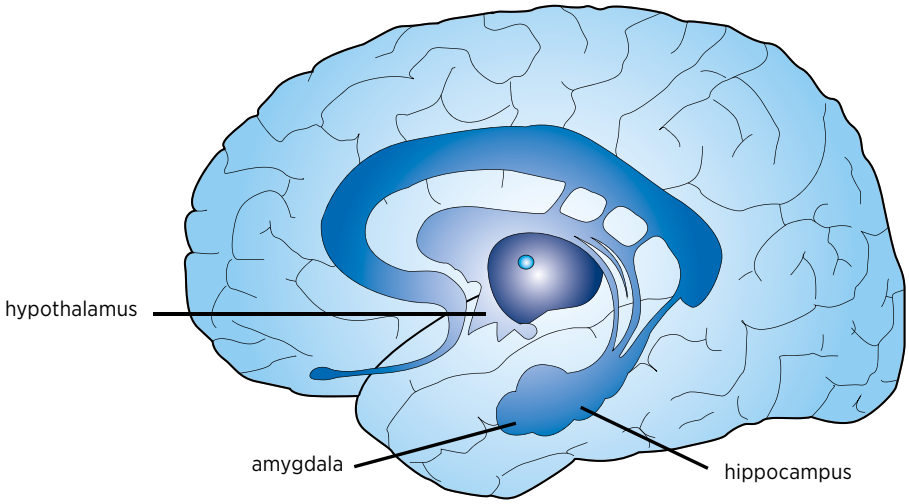

Figure 1: Limbic system structures involved in tinnitus perception

during acoustic reflex testing with stimuli too weak to actually produce a reflex, i.e. 40 dB).

While people with both subjective and objective tinnitus cases should have completed a consultation with a physician, if possible, a specialist in otolaryngology, prior to starting Widex Zen Therapy, it is particularly vital for objective cases since they might be related to a condition that is medically or surgically treatable.

Tinnitus may also be classified by manageability. That is, medically curable or treatable (as in the case of objective tinnitus, tinnitus associated with conductive hearing loss causes, Ménière's disease, labyrinthitis, sudden hearing loss, etc.), or medically non-curable (such as tinnitus associated with most sensorineural hearing loss).

Regardless of the physical cause of the tinnitus, what differentiates a person who has minimal or no negative reaction from the tinnitus, from one who is significantly bothered by the tinnitus, is the person's conscious or subconscious interpretation and reaction to the tinnitus. Therefore, a further classification divides people into those with minimal or no negative reaction, versus those with significant negative reaction. This classification is particularly relevant to the Widex Zen Therapy.

- For people who do not have significant negative reactions regarding their tinnitus, simple reassurance, basic counseling about the cause and likely course of the tinnitus, and, when the amount of hearing loss warrants, amplification containing the Zen tone and noise options may be sufficient.
- For people who do have significant negative reactions (that is, their reaction leads to increased attention, emotional, motivational, and behavioral distress), more extensive management of their attitudes and behaviors, relaxation exercises, and sound therapy (the three major components of Widex Zen Therapy) are appropriate.

There are many factors contributing to this negative reaction including fear of the unknown (such as what is the cause of the tinnitus, fear about whether the tinnitus will result in deafness, will the tinnitus interfere with sleep, work ability, or quality of life), and even anger from the perception that their concerns are not being taken seriously and they have been unfairly "dismissed" by hearing care professionals who have told them "there is no cure, you just have to learn to live with it".

When to treat?

The Widex Zen Therapy described in this manual is appropriate for all cases of bothersome tinnitus that cannot be medically cured or treated. However, as mentioned earlier, some people who have minimal or no negative reactions to their tinnitus may not require all of the components available in Widex Zen Therapy. For people who do require extensive treatment, it is generally true that once the medical evaluation has been conducted to rule out treatable or systemic etiologies, the earlier therapy can begin, the better. However, even people who have had tinnitus for many years can still achieve success using the Widex Zen Therapy.

Who are the members of the tinnitus management team?

There are certain people suffering from tinnitus whose needs cannot be fulfilled by the hearing care professional. While it is certainly not necessary for every person with tinnitus to be seen by all of the professionals

listed below, it is helpful for the hearing care professional who specializes in tinnitus treatment to be aware of or have access to professionals in the following disciplines so that appropriate referrals can be made, when necessary.

- Audiologist / auditory specialist / hearing aid dispenser
- Psychologist (for persons whose level of depression or anxiety is outside of your level of expertise, and for providing advanced cognitive-behavioral therapy)
- Psychiatrist (in case medications to help with depression or anxiety are needed)
- Otolaryngologist (to diagnose and manage medically or surgically treatable ear conditions)
- Physician (treatment plans should be coordinated with the person's personal physician)
- Neurologist (to diagnose and manage medically or surgically treatable neurologic conditions)
- Pharmacologist (to assist in determining potential drug interactions)
- Nutritionist (to advise regarding dietary intake)
- Temporomandibular Joint Specialist (for people with jaw discomfort or bruxism (grinding)
- Physical Therapist (for persons requiring cervical or other somatic treatment)
- Biofeedback Specialist (for providing methods of monitoring and altering physical stress)
- Sleep specialist (for helping people with sleep disorders such as apnea or providing assistance when your sleep aid suggestions are not sufficient)

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THERAPEUTIC OBJECTIVES AND OPTIONS

There are a number of tinnitus therapies currently in existence. Assuming the treatment is not a medical or surgical one designed to "cure" the tinnitus, most therapies have habituation as their goal.

What is habituation?

Most people who experience tinnitus go through a natural process of habituation. Habituation can be thought of as the process of "ignoring" (or becoming accustomed to) a stimulus without exerting any conscious effort. From a psychological perspective, it is defined as the adaptation, or decline of a conditioned response, to a stimulus following repeated exposure to that stimulus.

Habituation is a natural process that we experience thousands of times each day to stimuli that are not relevant to our well-being. Novel stimuli, however, and those that pose a threat to our well-being will tend to attract, and often maintain, our attention.

Some stimuli may seem similar, but in some cases will attract our attention and in other cases be ignored. For example, we are not normally aware of the sound of our own footsteps. But if we are walking down a dark alley late at night and a stranger is walking behind us, we will clearly "hear" those footsteps.

Examples of habituation include:
- not being aware of rings on our fingers
- not being aware of the tactile sensation of clothing on our bodies
- not being aware of a constant humming sound from a refrigerator

To achieve habituation, most therapies utilize a combination of acoustic stimulation and counseling. However, while each of the treatments described below have merit, they fail to address all of the important components producing distress in people with tinnitus, that is, the auditory, attention, and emotional (including relaxation strategies) considerations.

Available treatments, and a brief description of their characteristics follow. The treatments are divided into: 1) acoustic stimulation; 2) counseling and stress management; and 3) combination approaches.

Acoustic stimulation

Acoustic stimulation (sound enhancement) may facilitate habituation by increasing neuronal activity, decreasing contrast (between silence and tinnitus) in order to make tinnitus more difficult to detect, and minimizing the likelihood that the central auditory system will increase its sensitivity (gain) to detect "missing" auditory stimulation. Because it is widely accepted that tinnitus is related to an increase in central nervous system activity resulting from a peripheral attenuation (or decrease in auditory stimulation due to a hearing loss), it is logical to utilize acoustic stimulation for one of three purposes:
- Masking (covering up)
- Active listening (distraction)
- Passive listening (habituation)

Masking refers to an attempt to cover up the perception of tinnitus with another, externally generated sound. Many people with tinnitus have reported that when they are in noisy environments, for example, at a shopping mall, listening to loud music, or even while taking a shower, they are not aware of their tinnitus. Indeed, for most, though not all, persons, tinnitus is most apparent and annoying when the person is in quiet environments, likely because the contrast between silence and the tinnitus perception is greatest. Masking can either be complete (meaning the person cannot perceive the tinnitus at all) or partial, meaning that the perception of tinnitus is weakened). Many acoustic stimuli can be used for masking. In some cases, people experience residual inhibition (a temporary decrease in tinnitus perception) following the termination of the masker.

Active listening refers to a process in which the person attends, purposely or otherwise, to an acoustic stimulus. An example would be when a person listens to music or verbal commentary over the radio. This type of listening is often useful for distraction.

Passive listening refers to a process in which the person does nothing, purposefully or otherwise, to attend to an acoustic stimulus. An example would be walking through a shopping mall while physically hearing, but not being aware, that there is music playing from loudspeakers.

Tinnitus maskers:
Some people suffering from tinnitus use wearable devices that emit either a broad-band noise or a narrow-band noise centered around the perceived pitch of the tinnitus. The maximum output tends to span about 2.5 octaves between 1000 and 6000 Hz for broad-band noise maskers. The advantage of a narrow-band noise is that it doesn't have to be listened to at as high an intensity level to achieve masking. Most of these devices have volume controls that the person can adjust to achieve full or partial masking.

Home solutions:
Many sounds around the home can be used to mask or partially mask tinnitus. Among them are:
- Electric fans
- Personal MP3 players
- Home stereo units
- Television
- Radio (including static from radio set between stations)
- Bedside sound generators (with soothing sounds such as water running, nature, etc.)

Hearing aids:
Properly fitted hearing aids are effective in lowering the perception of tinnitus in over 60% of cases. This is not to suggest that the tinnitus is removed by the amplification or even suppressed (although it is in some cases). There are a number of reasons why hearing aids help persons with tinnitus. Among the things they do are:
- mask or partially mask tinnitus
- reduce contrast between tinnitus and silence
- alter production peripherally
- produce greater neural activity so that the brain does not attempt to compensate for peripheral attenuation
- create a more structured neural pattern
- reduce fatigue and stress allowing more resources to be allocated to tinnitus fight
- enhance communication ability (and reduce listening effort) – thus reducing stress and lessening its impact on tinnitus
- may facilitate habituation

However, amplification does not help all people with tinnitus. Among the reasons hearing aids may not help are:
- persons may have "reactive" tinnitus (meaning that sound actually seems to increase the tinnitus perception; fortunately this is fairly rare, reported by less than 5%).
- If improperly fit and programmed, could produce physical or loudness discomfort
- fear of what sound will do to the tinnitus
- stigma of hearing aids
- inadequate benefit / cost ratio
- the person may become frustrated if habituation doesn't occur within the first month

Combination devices:
Combination devices refer to wearable hearing aids that contain amplification and a sound generator that is able to produce noise, or other acoustic stimuli.

Counseling and stress management
Counseling for people with tinnitus can be considered as either instructional (directive) or adjustment (non-directive) based.

Both of these forms of counseling are valuable. Instructional counseling helps the person understand:
- the basic anatomy and physiology of the auditory (and central nervous) system
- **why** the tinnitus is present (particularly when it is a normal consequence of having a hearing loss)
- **what** the logical course of the tinnitus might be
- **how** the limbic system affects the tinnitus perception and how the person's reaction impacts the ability to cope with or habituate to the tinnitus.

Adjustment based counseling helps the person:
- **address** the emotional sequelae of tinnitus, including fear, anxiety and depression
- **identify** and correct maladaptive thoughts and behaviors
- **understand** the relationship between tinnitus, stress, worry, behaviors, thoughts, and quality of life.

Specific examples and an explanation of how instructional and adjustment based counseling is integrated into Widex Zen Therapy are provided in Part 2 of this manual.

An example of a therapeutic approach that provides adjustment based counseling is Cognitive Behavioral Therapy.

Cognitive-Behavioral Therapy (CBT)
Negative reactions to (and fear of) tinnitus hinder habituation from occurring and create a problem for the person. Indeed, it is the reaction, rather than the mere presence of tinnitus that differentiates a person requiring extensive treatment from a person who requires simple reassurance. A reaction is a behavior, and all behaviors are subject to modification. Psychological interventions aimed at reducing the stress, distress, and distraction associated with the tinnitus can be very beneficial. Many of the techniques reported to have produced success with the management of people with tinnitus have been modeled after approaches used for

chronic pain management because of the many similarities of tinnitus to pain (both are usually subjective, both are invisible, and both are affected by extraneous events). One example of a viable treatment is cognitive behavioral therapy (CBT). The goal of CBT is to modify maladaptive (unhelpful) thoughts and behaviors by applying systematic, measurable implementation of strategies designed to alter unproductive actions. CBT helps people identify thoughts (the cognitive portion) and behaviors (the behavioral portion) that sustain negative reactions and provides strategies to help alter these thoughts and behaviors. Components of CBT include cognitive restructuring, attention control, guided imagery, and relaxation training. CBT is optimally administered by a trained therapist, usually a psychologist. An explanation of how certain concepts and aspects of CBT can be integrated into Widex Zen Therapy as a form of intervention is provided in Part 2 of this manual.

Relaxation strategies:
Because stress decreases the ability of a person to successfully cope with tinnitus, and since stress is often manifested as a tightening of muscles, a variety of approaches designed to help a person relax have been used for people with tinnitus. Also, as mentioned earlier, the connection between somatic influences, such as tightening the jaw, grinding the teeth, or contracting neck muscles, can lead to increased tinnitus perception. Teaching the person how to quickly recognize changes in muscle tension, and how to implement immediate methods of relaxing those muscle groups can be very helpful. In addition, the practice of relaxation exercises, such as deep breathing and progressive muscle relaxation, can help reduce and manage excessive overall stress. Part 2 of this manual will provide details on these procedures as well as sleep management suggestions.

Combination approaches:
Because of the acoustic, attention, and emotional components of tinnitus, some tinnitus management approaches incorporate both counseling (mostly instructional) and acoustic stimulation.

Tinnitus Retraining Therapy (TRT)
TRT uses a combination of instructional (directive) counseling and auditory (low level sound) therapy to initiate and facilitate habituation to the tinnitus perception. According to this neurophysiologic model, there is an initial trigger or specific event that creates the tinnitus signal. The actual cause or anatomical site of generation for the tinnitus is not important. Following the detection of the phantom signal at sub-cortical levels, perception and evaluation is made at the auditory cortex. A conscious or subconsciuous interpretation is made by the limbic system (the emotional control center of the brain) that subsequently triggers release of neurotransmitters activating the autonomic nervous system. This process creates a gradual accumulation of

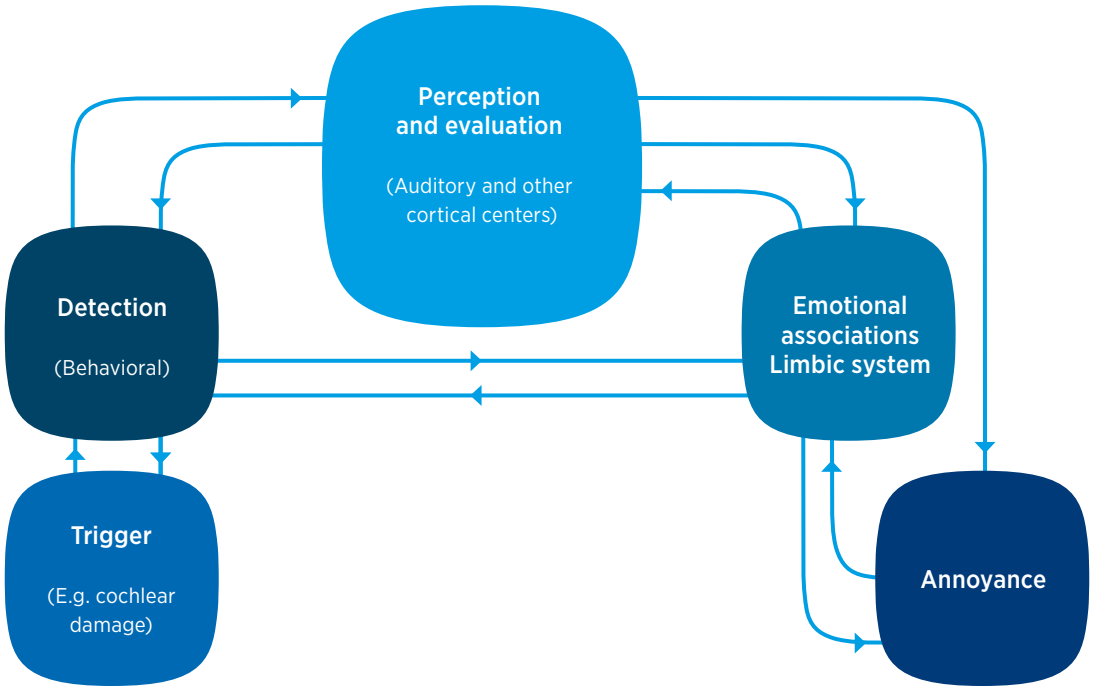

Figure 2: Following the detection of the phantom signal at subcortical levels an interpretation is made by the limbic system. If the limbic system associates tinnitus with fear or threat, the autonomic nervous system is triggered and attention is directed towards the tinnitus. (after Jastreboff, 1993).

"plastic" changes within the nervous system that either suppresses or maintains both the perception and the emotional reaction via a feedback loop. When the limbic system associates tinnitus with fear or threat, attention is directed toward the tinnitus. A diagram (Figure 2) illustrating this process is shown above. The counseling aspect of TRT is designed to educate the person so that the limbic system does not interpret the tinnitus as a threat. This "retraining" can occur because the brain is capable of separating meaningful stimuli from those which are not relevant. But this will only occur if the person's interpretation or reaction to the tinnitus does not carry a negative emotional association. So the goal is for the brain to adopt a pattern that de-emphasizes the importance of the tinnitus.

Coupled with the instructional (directive) counseling is the use of low-intensity sound therapy, or "sound enrichment". In order to reduce the contrast of tinnitus to silence and to decrease the likelihood of the central nervous system trying to overcompensate for any lack of auditory stimulation, silence should be avoided. A variety of methods can be used to provide acoustic stimulation. If hearing loss is present, hearing aids can be very helpful, as discussed above. If the person's hearing acuity is such that amplification is not appropriate, a broad-band noise generator coupled to the ear via an open fitting may facilitate habituation. TRT emphasizes that this noise is not meant to be utilized as a masker to completely cover up the tinnitus perception. In fact, the notion is underscored that initially, the tinnitus should be audible along with the low intensity noise signal. The objective is to have the tinnitus interact with a neutral sound, which is easily ignored. One should not actively listen to the chosen sound. To do so could activate the limbic system in an unwanted manner. The volume of the sounds should not be so high that it completely masks the tinnitus. Rather, the signal level should mix with the tinnitus in a manner such that both signals may be audible, but neither is particularly distressing. This can be defined as "the tinnitus interference or mixing level". This approach differs from the concept of masking, where an external sound is intense enough to cover up, inhibit, or alter the tinnitus perception.

Neuromonics:

The unique aspect of the Neuromonics approach is that it uses recorded music specifically chosen for its amplitude and tempo characteristics and then filtered in accordance with the person's hearing thresholds and delivered via a wearable system consisting of an MP3 like sound processor and high fidelity headphones. The sound processor provides a background of music mixed with white noise and filtered out to a high frequency (12,500 Hz). The recorded music is presented to the person with tinnitus at a relatively soft intensity level (designed to just interfere with the tinnitus perception), and to be listened to for 2-4 hours per day to induce relaxation and desensitization for a period of six months. The background white noise, which is employed to mask the tinnitus during the quiet intervals of the music, is utilized during the first couple of months of treatment and then phased out.

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STRENGTHS, **LIMITATIONS**, AND **COMPARISON** OF EXISTING APPROACHES

While each of the therapies discussed above have merits, limitations exist. For example with:

Tinnitus masking, which may be helpful, particularly in the early stages of tinnitus, to allow for temporary relief from the annoying perception.

1. if a hearing loss is present, the acoustic spectrum of the masking noise may either not be sufficient to reach the frequency region of the hearing loss, or the loudness of the masking stimulus might be set based on the best hearing region, thus not allowing for masking in the region of the tinnitus pitch;
2. it may require a high intensity to mask tinnitus, potentially causing too much distraction and interfering with concentration, or potentially even producing further damage to hearing;
3. a significant number of people suffering from tinnitus find that after a short period, a masking noise is nothing more than a substitute of one annoying sound for another;
4. masking does not address the long-term emotional issues related to tinnitus;
5. and most importantly, it is not possible to habituate to a stimulus (such as tinnitus) unless it is perceived and one is repeatedly exposed to it.

Amplification, which can help take the edge off of tinnitus for most people, does not specifically require counseling, but will likely be more effective when it is employed. Also, unless the hearing aids have a broad bandwidth and low compression thresholds, they may not provide adequate stimulation to affected regions or reduce contrast (by increasing gain) in quiet environments.

CBT, which can increase realistic, logical and rational thinking and is believed to relieve distress and reduce maladaptive behaviors, does not call for the use of sound enrichment, though practitioners have noted anecdotally that success using CBT may be enhanced when amplification is employed. In addition, it is typically delivered by psychologists, who may not have an understanding of the nature of the ear or impaired auditory system.

Neuromonics does not provide amplification, which may be important for the tinnitus sufferer who also has hearing loss, and the wearing of an MP3 player with headphones may be inconvenient and uncomfortable. Also, due to the fact that only four prerecorded music passages are used, it can become predictable, boring, and promote active, rather than passive listening.

TRT requires as much as 18 – 24 months of less active participation, and does not address emotional issues (despite the fact that as many as 40% of people with tinnitus suffer from anxiety or depression), or teach coping strategies.

None of the above described approaches directly address all of the problems that contribute to the distress experienced by people with tinnitus, such as hearing loss, sleep deprivation, maladaptive thoughts and behaviors, and/or excessive stress. Therefore, Widex has developed an integrated approach incorporating not only the optimal segments of existing therapies but novel acoustical stimuli and relaxation exercises as well.

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PART **2**

Objectives and rationale for Widex Zen Therapy

- The overall objective of Widex Zen Therapy is to ensure that the tinnitus does not negatively impact the person's quality of life!
- It does not purport to be a cure, or to suppress tinnitus (though it sometimes produces that effect).

COMPONENTS OF WIDEX ZEN THERAPY

Because it is well accepted that the distress related to tinnitus is highly correlated with hearing loss, negative emotions, fear, and stress, it is important to address these issues. Therefore, Widex Zen Therapy incorporates:

1. **Counseling** both instructional and adjustment based to educate the tinnitus sufferer and assist the limbic system alter the negative interpretation of the tinnitus. Cognitive and behavioral intervention is used when appropriate.
2. **Amplification** to stimulate the ears and brain in order to minimize increase in central activity (overcompensation) and maladaptive cortical reorganization.
3. **Fractal tones**, a novel, proven acoustic stimulus delivered dichotically in a discreet, inconspicuous and convenient manner, designed to both relax and provide acoustic stimulation.
4. **Relaxation** strategy program highlighted by behavioral exercises and sleep management strategies.

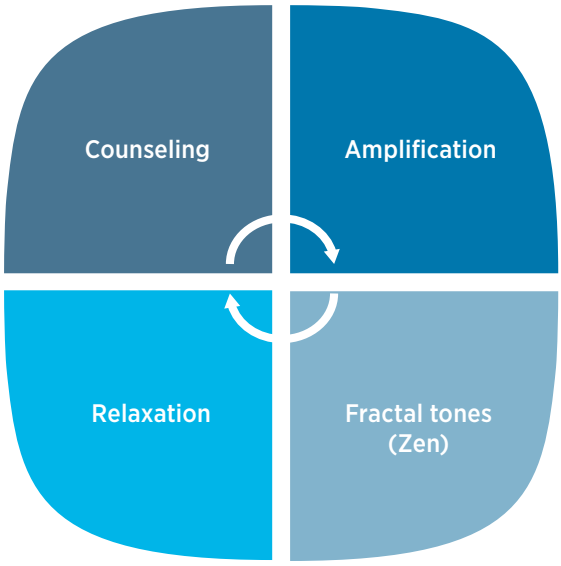

Figure 3: The components of Widex Zen Therapy

Widex Zen Therapy is unique because it is an integrated program addressing all three components of tinnitus distress, auditory, attention, and emotion. People suffering from tinnitus with minimal or no negative reaction may not require all the components of Widex Zen Therapy. For example, some may be helped adequately with simple counseling and education. Others may require counseling and amplification (offering the Zen fractal tones and noise option). But for those persons whose reaction to the tinnitus is severe and negative, an integrated program incorporating a combination of directive (instructional) and non-directive (adjustment based) counseling using cognitive-behavioral intervention, amplification, Zen acoustic programs, and relaxation exercises will provide maximum effectiveness.

In order to determine which components of Widex Zen Therapy are appropriate for a given person, it is necessary to begin the process with a thorough intake process consisting of a formal written questionnaire, subjective measures (determining the person's reaction to and distress from the tinnitus) and a personalized interview. A comprehensive audiologic evaluation establishing certain characteristics of the tinnitus can either precede this intake process or immediately follow it. After the characteristics of the tinnitus and the person's reaction to the tinnitus have been established, appropriate components constituting the Widex Zen Therapy will be determined for that individual. A discussion and a chart illustrating how one determines which Widex Zen Therapy elements are appropriate for a given person will be presented after the following description of each component:

Intake process

The purpose of the intake process is to understand the person's history, needs, fears, and expectations so that you can individualize the Widex Zen Therapy for that person. You can conserve time by sending the Widex Zen Therapy Intake questionnaire and the subjective tinnitus measures to the person before the appointment, and then you can discuss the results directly with the person during the personalized interview.

Questionnaire

The Widex Zen Therapy Intake questionnaire (Appendix A) gathers information regarding the following topics:

- Tinnitus history (duration, location, perceived sound, what was occurring when it was first noticed, knowledge regarding cause, recent changes).
- Otologic and medical history.
- Reaction to tinnitus (questions regarding the degree to which the person is bothered, and the percentage of time the person is aware of the tinnitus, versus the percentage of time the person is bothered by the tinnitus). This is an important distinction, because it will help you establish a dialogue with the person regarding cognitive exaggerations, that is, some people will indicate they are bothered by the tinnitus 100% of the time, but upon further questioning, they can easily identify instances in which they were not thinking about the tinnitus, for example, during an exciting movie, football game, or play time with children or grandchildren).
- Factors that affect the tinnitus, such as external sounds, stress, fatigue.
- Reaction to loud sounds. In addition to loudness recruitment (abnormally rapid growth in loudness caused by cochlear damage), some persons with tinnitus also suffer from loudness disorders such as hyperacusis (when even moderately intense sounds seem too loud), misophonia (dislike of certain sounds such as the voice patterns of other people or coughing), or phonophobia (fear of sound, in general). These reactions must be taken into consideration when programming the hearing aids and when counseling.
- Sleep issues: too often, hearing care professionals ignore the effect sleep deprivation has on the ability to cope with tinnitus. It is important to find out how long the person typically sleeps at night (recognizing that the older we get, the less sleep we need), and how long it takes to fall asleep.
- Audiologic history, including whether the person perceives a hearing problem.
- Treatment for hearing loss, has the person worn hearing aids before and how did they affect the tinnitus?
- Diet and exercise habits (it is important to emphasize that since tinnitus is a quality of life issue, it is important to not only change attitude and behaviors related to the tinnitus, but also to alter factors affecting overall quality of life).
- Medications (are there any potential drug interactions?).
- Previous treatment for tinnitus; this will help you establish whether the person is unrealistically focusing on “the cure”.
- Overall emotional pattern; this will help determine if there are signs of depression and anxiety that may require additional professional referrals.
- Factors that create stress (job related, problems at home, difficulty with time management, financial hardships).
- Current employment (this question is used to help determine how the person spends the day, that is, is there too much time spent dwelling on the tinnitus or is the person keeping active?).

Subjective scale measures

Subjective tinnitus severity measures are designed to 1) quantify how the person is reacting to the tinnitus and how it is affecting quality of life; 2) identify aspects of the tinnitus and related behaviors and attitudes that are most bothersome to the person; and 3) establish a baseline score from which you can assess progress. This information is not only important for counseling purposes but also for establishing which components of Widex Zen Therapy are necessary. Several well researched scales are available, each requiring approximately 5-10 minutes to complete. They can be administered while sitting with the person, but for time conservation, it is often useful to let the person fill them out in the waiting area, or even at home prior to the appointment day.

For Widex Zen Therapy, it is recommended that the newly released Tinnitus Functional Index (TFI) be employed.

<u>Tinnitus Functional Index</u>

The TFI is a questionnaire consisting of 25 items designed to address 8 important domains of negative tinnitus impact: intrusiveness, reduced sense of control, cognitive interference, sleep disturbance, auditory difficulties attributed to tinnitus, interference with relaxation, quality of life reduced and emotional distress. Each of the 8 subscales consists of 3 items except for the quality of life subscale which consists of 4 items. All items are scored using a percentage score or a 0-10 scale giving a maximum possible score of 250. The overall TFI score can be defined by dividing the total score by the number of answered questions and by multiplying by 10. Performing this calculation, the overall score will be given within a 0-100 range.

The TFI is useful for scaling the severity and negative impact of tinnitus, for use in intake assessment and for measuring treatment-related changes in tinnitus. It also provides comprehensive coverage of multiple tinnitus severity domains. This scale, which was designed and tested by a dozen of the world’s most respected authorities on tinnitus, is highly recommended because of the manner in which it is sub-divided, the comprehensive nature of the questions, and, while other tinnitus

measures assess the severity and complex nature of tinnitus, little information exists regarding their ability to measure treatment outcomes. The TFI was designed and has been shown to be responsive to treatment-related changes in tinnitus.

In addition, for hearing care professionals who are familiar with other scales, the following three well documented scales also may be utilized:

Tinnitus Handicap Inventory
The THI is a scale consisting of 25 items requiring an answer of yes (4 points), sometimes (2 points) or no (0 points). Thus, scoring can range from 0-100 points. The THI uses questions that assess three primary areas; 1) limitations (difficulty concentrating, not enjoying social activities such as going out to dinner, having trouble falling asleep at night?, 2) emotional issues (anger, frustration, depression) and catastrophic reactions (desperation, loss of control, inability to cope, feeling you have a grave disease).

The minimum THI score considered clinically significant is 18. The interpretation of the scores is:
0 – 16 Slight (Only heard in quiet environments) GRADE 1
18 – 36 Mild (Easily masked by environmental sounds and easily forgotten with activities) GRADE 2
38 – 56 Moderate (Noticed in presence of background noise, although daily activities can still be performed) GRADE 3
58 – 76 Severe (Almost always heard, leads to disturbed sleep patterns and can interfere with daily activities) GRADE 4
78 – 100 Catastrophic (Always heard, disturbed sleep patterns, difficulty with any activities) GRADE 5

Tinnitus Reaction Questionnaire
The TRQ is a questionnaire consisting of 26 items designed to quantify the psychological distress associated with the tinnitus. The test ranges from an answer of almost all the time (4 points), most of the time (3 points), some of the time (2 points), infrequently (1 point), and not at all (0 points). Therefore there is a possible score of 0–104 points. The TRQ looks for general distress (feeling helpless, interference with ability to work), severity (interference with sleep), and avoidance (noisy situations).

The TRQ doesn't classify the total score in terms of severity of the tinnitus reaction, however, answers to individual questions can provide you with further insight about how the tinnitus is affecting the person.

Tinnitus Handicap Questionnaire
The Iowa THQ consists of 27 items that require a 0-100 response from the subject depending on how much they agree with the item. The total score is an average of the scores for all 27 items. There are 3 factors underlying the subjects' responses. Factor 1 addresses the individual's physical health, emotional status and social consequences of tinnitus (15 items). Factor 2 addresses the individuals' hearing difficulty related to tinnitus (6 items). Factor 3 addresses the person's view on tinnitus (4 items). The questionnaire was normed on 275 patients seen at the VA, ENT and audiology clinics around Iowa. Thus, an individual's scores may be compared to the norm to estimate severity and need for treatment. In addition, this is the only tinnitus questionnaire prior to the TFI that addresses the impact of tinnitus on hearing ability; as such, it may be most effective to measure the effect of amplification on tinnitus not seen in other questionnaires.

While each of these latter three scales have some overlap, they differ in that the TRQ is designed to measure general distress, the THQ looks at aspects of the hearing problem in addition to the tinnitus problem, and the THI provides the most specific "clinical classifications".

Copies of all four measures are shown in Appendices B, C, D, and E.

It may be useful to watch for signs of depression and anxiety. Behaviors to watch for include:
- High level of anxiety or depression
- Obsessional focus on tinnitus
- Significant work impairment
- Significant weight loss not associated with diet or illness
- Marginal coping skills and lack of adequate support system
- Refusal of tinnitus tools but requests for excessive or inappropriate treatment

Presence of these behaviors may indicate need for a referral to a qualified psychologist or psychiatrist.

Audiometric tests
In addition to the information obtained from the questionnaire and subjective measures, it is important to obtain test information regarding the status of the person's hearing and auditory system. For both subjective and objective assessment, it is important that the person understand the purpose in asking the questions and in performing diagnostic testing.

A number of potentially useful test procedures are described below. It is important to understand, however, that with the exception of the audiogram, the

other procedures are not required for Widex Zen Therapy.

Among the test procedures useful in the diagnostic audiologic battery are:

- Audiogram (to ascertain the degree and configuration of hearing loss as well as to identify potential causes of the tinnitus, e.g. hearing loss).
- Tinnitus characterization (some refer to this as matching) establishes an acoustical representation of the person's perceived subjective experience. While not essential in determining the required components of the Widex Zen Therapy, the process (which takes 5-10 minutes) is appreciated by many people with tinnitus because it provides validation of their acoustical experience. It may also be useful to present a reproduction of the tinnitus experience to a family member so that others have the general familiarity of what the person perceives.

Pitch measure

The test ear is the one contralateral to the predominant or louder tinnitus, if there is a difference between the two sides. If the tinnitus is equally loud on both sides or is localized in the head, the test ear is the one with the better hearing. Present pairs of tones and ask the person to identify which one best matched the pitch of the tinnitus (two-alternative forced-choice (2AFC) method). Test frequencies are typically multiples of 1 kHz. Before each tone pair is presented, adjust them to a loudness level equivalent to that of the tinnitus. Once the dB settings for a given pair of tones are established, the two tones are then presented in alternating manner until the person indicates which one was closest to the pitch of the tinnitus. A typical test sequence might yield a pitch match of 4000 Hz as the closest to the tinnitus pitch, as follows:

	Comparison Tones (Hz)	**Tone Judged Most Like Tinnitus**
Trial 1	1000 vs 2000	2000
Trial 2	2000 vs 3000	3000
Trial 3	3000 vs 4000	4000
Trial 4	4000 vs 5000	4000

Be sure to randomize the selection of which tone is presented first in each trial, so that the lower of the two frequencies is not always the one presented first. Also, it is helpful to make certain that the person is not making an octave band confusion (for example, erroneously stating 4000 Hz as the match, when indeed it was 8000 Hz.) To do this, simply present a tone that is one octave higher than the one matched and have the person state which one was closest to the tinnitus.

Loudness matching

The test ear should be the same ear as when you performed the pitch measure. If the tinnitus is equally loud on both sides or is localized in the head, the test ear should be the one with the better hearing, particularly if it has normal hearing because it can provide a more accurate assessment of perceived loudness, as it will not be contaminated by the presence of loudness recruitment. The sound level is increased in small steps (1 or 2 dB) until the person reports that the external tone is just equal to the loudness of the tinnitus. It is important to start with the test tone below the person's threshold and use only an ascending series of intensity levels in order to minimize the possibility of discomfort or invoking residual inhibition. The dB level of the loudness match can be recorded in dB SL (Sensation Level, i.e. dB above threshold). It may also be useful to repeat the process to determine reliability. It is important to indicate in which ear you performed the measure.

Minimum Masking Levels (MMLs)

This test determines the lowest level at which a narrow or broad band of noise fully masks the tinnitus (i.e. renders it inaudible). The test ear is typically on the side with the louder or predominant tinnitus; but if there is no difference between the sides, each ear can be tested separately. Measure the person's threshold for the noise band, and raise the level of the noise band in 1 dB steps until the person reports that the tinnitus is no longer audible (up to the limits of the equipment or the person's tolerance level, whichever is reached first). The level at which the tinnitus is just rendered inaudible is recorded in dB SL and referred to as the MML. If the masking sound is able to render the tinnitus inaudible, that result is recorded as “complete masking”. In some cases, the masking stimulus will only be able to make the tinnitus somewhat less audible (i.e. quieter than usual), and should be recorded as “partial masking”. In a small percentage of cases, the masking stimulus will have no effect on the loudness of the tinnitus (masking effect recorded as “none”). In rare cases, the tinnitus can be reported as louder for a short period following the presentation of the masking stimulus (and this should be recorded as “exacerbation of tinnitus”).

Residual inhibition (RI)

Following the masking tests (and assuming there was no exacerbation of the tinnitus), the level of the masking stimulus (noise band) is adjusted to MML + 10 dB. Prior to turning the stimulus on, inform the person that the masking sound will now be presented for 1 minute,

but that if it is uncomfortable the person should ask to have it stopped. The masking stimulus (MML + 10 dB) is then presented for exactly 60 seconds; and as soon as it is turned off, the person is asked "How does your tinnitus sound right now (reduced, absent, louder, the same)?" This test can be repeated for each ear, if appropriate, and in addition may be done binaurally.

Commonly, people report that their tinnitus is reduced or absent in the stimulated ear for a brief interval ranging from a few seconds to many minutes; after that, the typical situation is that the tinnitus gradually returns to its normal loudness level. Many people with tinnitus do not exhibit any residual inhibition.

Loudness Discomfort Level (LDL)
Because tinnitus is often associated with loudness disorders, as mentioned earlier, it is important to determine the intensity level at which the person experiences discomfort. This may also help the advanced hearing care professional in programming the parameters of the hearing aids. Prior to administering this test, be certain to inform the person about what, and why, you are doing and reassure the person that if discomfort is experienced, you will stop the test immediately.

The exact instructions have a considerable effect on the outcome of the test.

Instructions can be given verbally or in writing. An example of instructions is:
"I will gradually make the sound louder in your ear, please tell me (by pressing the button or raising your hand) as soon as the sound becomes uncomfortably loud. This is not a test to find the loudest sound you can tolerate; it is a test to find what level of sound you find uncomfortable. You should press the button only when the sound becomes uncomfortable– but make sure you press it as soon as the sound reaches that level."

Observe the person's face at all times. Starting at a level predicted from the audiogram to be comfortable, present tone pulses for a 1 second duration followed by at least a 1 second quiet period. Ascend in 5 dB steps until the person indicates that the uncomfortable level has been reached. If the person shows any distress or flinching during the test, stop immediately.

Otoacoustic Emissions (OAEs)
These are rarely associated with subjective tinnitus, but finding cochlear damage in conjunction with a normal audiogram can help explain the cause of the tinnitus.

Ultra high frequency testing
It may be significant to determine hearing loss in frequencies above 8 KHz because in conjunction with a normal audiogram, it may help explain the cause of the tinnitus.

Immittance/reflexes/decay
Immittance testing can be useful in detecting a pulsatile tinnitus, as explained in Part 1. However, caution should always be exercised when using the high intensity levels required to detect acoustic reflexes, or even in performing tympanometry.

Initial interview
Once the intake has been completed, the initial interview is performed in order to:
- review the findings
- educate the person regarding the probable cause and potential course of the tinnitus
- provide appropriate reassurance that the tinnitus does not represent a grave illness or a progressive condition (established based on the previously conducted medical examination discussed in Part 1)
- establish the individualized plan for the Widex Zen Therapy.

Suggestion: whenever possible, try to involve a family member. Like hearing loss, tinnitus can have a profound effect not only on the person, but on the entire family. Bringing in a family member or friend can not only provide emotional support but can help motivate the person to comply with your recommendations.

Counseling
Counseling requires establishing a trusting relationship with persons with tinnitus. They need to understand that you care about more than simply their hearing status (or selling hearing aids to them) and that your role is to guide them through a journey that is based on scientific evidence in order to reach a status where the tinnitus is not negatively impacting their quality of life. In doing this, you must not pretend you have all the answers. Be honest, and supportive, providing hope but not promising goals you cannot achieve. Inform the person that progress will not only be based on the tools and techniques you will provide, but also on the person's active participation and willingness to engage in cognitive (attitude) and behavioral adjustments.

One of the first things you need to convince the person of is that there is indeed hope. Many have heard the ill-advised phrase "There is no cure, you just have to learn to live with it". Remind the person that "there is a big difference between no cure and no help". Millions of people with tinnitus have indeed conquered, or habitu-

ated to, their tinnitus, and so can this person. It will be a journey, and will take effort, but you will be there to provide the tools and support to get it done.

As stated earlier, counseling is typically both instructional and adjustment-based. Instructional counseling entails providing information directly related to the person's hearing loss and tinnitus. In addition, it is here that you should discuss the relationship between impaired hearing and tinnitus perception, as well as the reasons why there is commonly an emotional connection established in the brain between the limbic system, autonomic nervous system, and the auditory cortex.

The Widex Tinnitus program contains a flip chart that can be used to provide this information to the person.

Instructional counseling:

A logical 15 step outline for instructional counseling includes:

1. review the Widex Zen Therapy intake questionnaire;
2. review the severity scale results;
3. inform the person of the millions of people who have tinnitus and that habituation will occur naturally for about 90% of them;
4. provide reassurance that the tinnitus does not mean the person is going deaf, dying, or going crazy; and that the medical consultation performed prior to this appointment suggests there are no significant medical conditions present;
5. explain that we hear in our brain, not just in our ears, and that we know that tinnitus comes from the brain, and not simply the ears;
6. discuss basic anatomy of the peripheral and central auditory system, describing where the tinnitus is likely originating (peripherally) but being interpreted (centrally);
7. review the audiogram;
8. establish the relationship between hearing loss and tinnitus (that is, discuss the brain's drive to overcompensate for what it is not getting from the ears). This will begin to establish the need for hearing aids;
9. discuss other factors that may be contributing to the tinnitus (somatic);
10. describe the physiologic relationship of emotions (limbic system) to perception and the fact that there is a clear feedback loop or vicious cycle of tinnitus distress between a negative reaction and increased tinnitus (and vice versa). Provide a basic explanation of the diagram (Figure 2) in Part 1 that shows the "neurophysiologic" model describing how the brain and emotional system "locks" on to the tinnitus perception;
11. explain that it is the negative reaction or interpretation of the tinnitus and not necessarily the characteristics (for example, the loudness) of the tinnitus that is relevant. You can use this example; "a very soft signal that carries a potential warning to danger (such as the soft squeaking sound of a floorboard in an adjacent room when no one is believed to be in that room) will gain attention and place the autonomic nervous system on sustained alert much more so than louder sounds such as thunder, which does not signal a potential negative outcome";
12. explain that the association of fear and tinnitus can be conscious, or subconscious, that is, the fear reaction can occur without conscious awareness, but that either way, the reaction can be modified; (A script you can use to explain how the brain suppresses irrelevant signals, including tinnitus, is presented just below this 15 step outline);
13. explain the natural process of habituation;
    a. provide examples of habituation (ignoring the ring on your finger, glasses on your nose, etc. – see script below);
    b. ask the person to identify other examples of habituation;
    c. ask the person to identify times and situations when the tinnitus is not noticeable (all of these are intended to prove to the person that the brain is indeed capable of suppressing a physical perception);
    d. remind the person that anytime they think about the tinnitus, it means that a moment before that, they weren't thinking about it. This helps realistically frame the time the person is truly "bothered" or consciously thinking about the tinnitus;
    e. ask the person to list barriers to habituation. These may include: stress, lack of perceived support, poor coping skills, fatigue, lack of insight into the problem, and irrational thoughts, fears, and attitudes leading to maladaptive behaviors;
14. ask the person "what will make this encounter or therapy successful in your mind?". The purpose of this question is to establish realistic expectations and to make certain that the person clearly understands the objectives of the Widex Zen Therapy intervention;
15. explain to the person that the objective of the Widex Zen Therapy is NOT to cure the tinnitus but rather is to address all the components that produce tinnitus distress. In other words, to a) initiate and facilitate tinnitus habituation by helping the brain (particularly the limbic system) reclassify the tinnitus as a non-salient (non-important) signal that may even be a natural consequence of damage to the hearing mechanism (though this explanation only applies to people presenting hearing loss); b) provide state-of-the-art amplification plus fractal tones to stimulate the brain, thus allowing it to not attempt to overcompensate; and c) relax using a scientifically proven form of music combined with relaxation exercises to reduce stress.

Script explaining how the brain suppresses signals:
"Most sensations occurring in the body are naturally suppressed by the brain as long as the brain considers them to be irrelevant. Consider, for example, that at this very moment, you are not aware of the feeling of your clothing or rings on your fingers. Here is why. Different parts of your brain respond to different senses. For example your auditory cortex responds to sound, your somatosensory cortex responds to touch, etc. When the sensation is received by these regions, the neural pattern is analyzed and the data are sent to the limbic system, located deep in your brain. In the limbic system the source of the stimulation is identified (by a structure called the hippocampus), and a decision is made (by the amygdala) regarding whether or not the sensation is relevant and needs to be attended to, or whether it is irrelevant to your well-being and should be suppressed. A similar situation exists with sound. If you move from a quiet neighborhood to one near an airport, you may initially find that the frequent noise from the airplanes is quite distracting and annoying. Yet, after a short period of time, you may no longer consciously perceive the sounds, and the distraction and annoyance diminish. Of course, if you actively listen you will be able to hear the airplanes. In other words, the sound is there and is reaching your brain, but your brain has analyzed it and decided that it is not important for you to attend to and that it should be suppressed. This is an important, natural, and automatic function that your brain performs thousands of times each day. If it didn't do this, you would be overwhelmed with irrelevant sensations. Unfortunately, automatic functions cannot be easily and consciously controlled. In other words, you cannot "will" away a sensation by actively trying not to experience it.

The brain is also capable of accomplishing the same suppression for tinnitus, but it is more difficult. Let's examine why. Because it is the auditory cortex that is receiving this signal, the assumption is made that this must be a sound. However, unlike airplane noise, the tinnitus is not a real sound; it is merely an electrical signal which the auditory cortex cannot properly analyze. If the brain cannot properly analyze the tinnitus, the limbic system has great difficulty deciding whether this "fake" auditory perception is relevant or not. In fact, tinnitus often becomes associated with a very negative meaning. After all, no one really likes "hearing" tinnitus, and it can trigger fears of progression, underlying serious illness, difficulty sleeping and concentrating, etc. Thus, the limbic system may logically, but erroneously, decide that the tinnitus might be relevant and 1) directs the auditory cortex to keep analyzing it, and 2) directs the autonomic nervous system (the part of your nervous system that controls "automatic" functions such as breathing and heartbeat) that there is something wrong and it should be on alert. This subsequently creates a release of chemical and electrical messages that may induce stress and anxiety, and a vicious cycle occurs: you feel stressed by the tinnitus, and the stress encourages your brain to focus more on the tinnitus.

A simple structure for remembering the sequence of the brain's analysis of the tinnitus is:
1. the auditory cortex analyzes
2. the hippocampus identifies
3. the amygdala determines salience (importance)

Adjustment based counseling:
Once the person understands the connection between the limbic system and the attention paid to tinnitus, it is important to also integrate adjustment based counseling. The adjustment based counseling is bi-directional. That is, it 1) helps you understand the person's perspective and thereby what he or she brings in terms of experiences, knowledge, opinions, feelings and prejudices towards the tinnitus. This provides the hearing care professional with important information regarding who the person is and what treatment plan should be created for that individual; and 2) helps the person identify and challenge irrational and maladaptive thoughts, beliefs, attitudes, and behaviors that contribute to distress and fear of tinnitus.

In order to reach a mutual understanding and a constructive dialogue a 3-part process consisting of a description phase, an evaluation phase and a rehabilitation phase can be helpful. Together, you share the responsibility for the process. It is, however, your responsibility to give them space and encouragement to assume their share of the responsibility.

<u>The descriptive phase</u>
In the descriptive phase, ask questions to investigate the life experience and frame of reference of the person. A successful tool to accomplish this is to ask open questions and remain non-judgemental during this initial dialogue. This can be challenging for the hearing care professional. You must acknowledge that although you know a lot about tinnitus, hearing loss, audiology and hearing aids, you know relatively little about

the person sitting in front of you. Silence can be a very powerful tool in this phase. When the hearing care professional allows periods of silence in the dialogue, the person can experience increased awareness about his thoughts, preconceptions and emotional reactions because the hearing care professional is listening and focusing attention on him. It often will bring forward the person's feelings because silence "requests" that he talks.

Maintain good eye contact and stay aware of non-verbal communication. This can help you determine how the person is reacting to the discussion. For example, does the person appear defensive (i.e. arms crossed across the chest), confused, saddened, disinterested? Also, be aware of your own non-verbal signals. It is often your non-verbal communication that gives away your true thoughts and intentions.

Tinnitus may be associated with many emotions: lack of control, fear, shame, frustration and isolation. As a hearing care professional it is important to be conscious of these feelings and their presence. If they are left unattended, they may block a potential successful outcome. It is important to register and acknowledge the emotions the person with tinnitus displays in the interaction with you. Sometimes people show sadness and sorrow. These emotions are often difficult to handle. If you acknowledge the emotions you witness, the person will feel more comfortable and welcome, regardless of his emotional state. Remember, feelings and emotions (unlike thoughts and behaviours, as discussed below) are personal, honest, and should not be challenged.

The evaluation phase

In the evaluation phase, it is important to make sure that you have understood the person correctly. An effective and welcoming way to do this is to reflect or rephrase the central points of what the person has said, for example, "What I am hearing you say is..." or "Have I understood you correctly...?" You accomplish two things by applying this strategy. First, you show the person that you have listened carefully and second, you allow the person to correct any misunderstandings that might have occurred. During this phase you might also clarify the person's statements by asking questions such as "When you say you cannot concentrate because of your tinnitus, do you mean always or are there specific situations where it is more difficult than others?" or "When you say you are aware of your tinnitus 100% of the time, can you think of any time where this is not true?" These questions help you and the person clarify his or her situation. This is also called obtaining "operational statements".

The rehabilitative phase

Only after the dialogue has evolved through the description and the evaluation phases can you proceed to the rehabilitative phase. You have now achieved an understanding of the person in front of you. His tinnitus problems and his hopes and expectations are well known to you and you are aware of what his unique problem is. This knowledge, combined with the review of not only the total scores, but the individual responses to the questionnaire and subjective scales (TFI, THI, THQ or TRQ), will facilitate the choice of an appropriate treatment plan, since it is the knowledge conveyed to you by the person that provides the foundation for all the recommendations you choose to put forward. The rehabilitative phase may take many directions. For example, some persons might be able to begin habituating naturally, now that they have received an education about the nature of the tinnitus, and the fact that the tinnitus may not be relevant to their well-being. Others will require the sound based tools or relaxation exercises which will be described shortly. For some people instructional and adjustment based counseling as described above might not be enough. For these persons Widex Zen Therapy recommends the use of cognitive behavioral intervention (CBI) to help the person identify barriers to achieving natural habituation.

Cognitive behavioral intervention

As described earlier, some psychologists effectively utilize cognitive-behavioral therapy (CBT) for treating depression, anxiety, and tinnitus. When people are in distress, they often do not think clearly and their thoughts are distorted in an unrealistic and unhelpful manner. CBT helps people identify their distressing thoughts and evaluate the validity of their thoughts. This approach helps people learn to change their distorted thinking, and when they feel more realistically, they feel better. CBT is a time intensive approach, and might be beyond the expertise of many hearing care professionals.

CBI incorporated into WZT is, like CBT, designed to identify unwanted thoughts and behaviors hindering natural habituation, challenge their validity, and replace them with alternative and logical thoughts and behaviors. The objective is to remove inappropriate beliefs, anxieties and fears and to help the person recognize that it is not the tinnitus itself that is producing these beliefs, rather it is the person's thoughts and reactions (and all thoughts and reactions are subject to modification). CBI, like CBT, is based on cognitive theory. Cognitive theory states that the thoughts we have regarding situations or events influence how we feel emotionally. In other words, it is not the event itself that creates our emotional response but the content

of the thoughts concerning the event that creates the emotional response. (See Fig 4). For example, imagine a person stuck in traffic and running late for a meeting who might be thinking "oh, no my client is going to be angry with me". This thought leads to the emotional response of feeling anxious. This emotional response then produces a physical release of neurotransmitters and chemicals which create sustained anxiety. If the person instead interpreted the event (running late for the meeting) as "There is nothing I can do about the traffic – my client will understand", the emotional response will change to acceptance and the physiologic presence of anxiety will be lessened. The same principle applies to emotional responses regarding tinnitus. For example, a person with tinnitus may be invited to a party. The person might think "I cannot go; it will make my tinnitus worse. I won't be able to hear people and they will think I am stupid". This thought would create an emotional response of hopelessness and irritation. If the person instead thinks "I will go, I can manage it and socializing is good for me because it will get my mind off of the tinnitus", the emotional response will change to hopefulness and even optimism.

The Widex Tinnitus program contains a flip chart that contains additional examples and can be used to explain the rationale behind cognitive behavioral intervention to the person with tinnitus.

<u>The basic processes in cognitive-behavioral intervention follow:</u>

1. Explain the rationale behind the cognitive behavioral intervention to the person
   Presentation of the rationale behind the cognitive behavioral intervention is important, as it is more likely that people will use the techniques if they understand why these techniques are being suggested. Explaining the rationale also illustrates the hearing care professional's respect for the person and assists in the development of a collaborative approach.

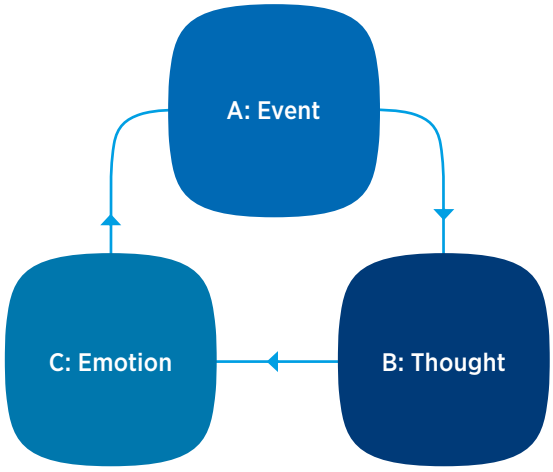

Figure 4. A refers to the situation or event a person experiences. B refers to the thoughts, beliefs, and perceptions the person has about the situation and C refers to the emotional state (Henry, Wilson, 2001).

2. Identify negative thoughts
   The person needs to understand that the way he thinks about tinnitus impacts his emotions, and subsequently his physiologic reaction. Thus, it is essential to distinguish between the tinnitus itself, his thoughts, concerns, and fears about the tinnitus, and his emotions, reactions, and behaviors. You might start by asking him to identify examples of events, thoughts, and emotions (the flip chart contains an assignment for this). Then ask him to identify events that have created specific negative emotional responses for him, and then ask him to focus on the thoughts he had in relation to that event. This can be done either face to face with the person or by providing a chart (or worksheet as shown below) for the person to complete at home.

Event	Thought	Feeling
Invitation to a social gathering	I can't go. My tinnitus will get worse	Hopelessness, despair, frustration
Inability to hear what was said during a party	People think I'm stupid when I ask them to repeat things I don't hear	Anxiety, isolation
Tinnitus is getting louder	I can't go on with this. I would rather be dead	Depression, suicidal feelings
Inability to concentrate	I am unable to perform at work, I am going to get fired from my job	Anxiety, hopelessness, fear

3. Identify and challenge cognitive distortions (thought errors)
   Once the person recognizes the relationship between tinnitus, thoughts, and subsequent emotions, reactions, and behaviors, you can then introduce the concept of cognitive distortions and methods to challenge these distorted, maladaptive thinking patterns.
   Provide the person with the following list and examples of common cognitive distortions and ask him or her to circle which ones he might have experienced.

- All or nothing thinking = no shades of gray; "My life used to be perfect before I had tinnitus, now it is horrible".
- Mental filter = one aspect of a complex situation is the focus of attention, while others are ignored; "I was having a good time at the party, but hearing my tinnitus ruined everything".
- Mind reading = assuming others' thoughts without evidence, "People think I'm stupid when I ask them to repeat things I don't hear because of my tinnitus.
- Jumping to conclusions = assuming negative expectations about future events as established facts, "I am bound to have a miserable day when I hear my tinnitus first thing in the morning".
- Emotional reasoning = assuming emotional reactions reflect the true situation, "My tinnitus makes me feel hopeless, there is no hope".
- Overgeneralization = an event is characteristic of life in general, as opposed to specific, "Because of my tinnitus I was awake all night. Every night is the same."
- Disqualifying the positive = positive experiences that would conflict with negative views are discounted; "I didn't think much about my tinnitus today, but that was a fluke".
- Catastrophizing = negative events are treated as intolerable rather than in perspective, "My tinnitus is louder, I must be going deaf".
- Should statements = using should and have to statements to provide motivation or control, "I should never have listened to rock music, I did this to myself".
- Personalization = assuming one is the cause of a particular event when in fact other factors are responsible; "I ruined everyone's evening because I was miserable".
- Labeling = attaching a global label to oneself rather than to specific events or actions; "Having tinnitus (and hearing loss) makes me a disabled person"

Next, ask the person suffering from tinnitus to look at his own negative thoughts, identify cognitive distortions, and then produce alternative thoughts. If the person is unable to do so, gently guide the thoughts in the right direction. This can be done by utilizing a worksheet for the person to complete (either with you, or at home). An example for each cognitive distortion follows:

Negative thought	Cognitive distortion	Alternative thought
My life used to be perfect before I had tinnitus, now it is horrible	All or nothing thinking	Life is never perfect, I had some problems before, and I still have some good things about my life now (like my grandchildren)
I was having a good time at the party, but hearing my tinnitus ruined everything	Mental filter	Many people struggled to hear at that noisy party but still had a good time. I could have moved toward a corner of the room that wasn't so noisy
People think I'm stupid when I ask them to repeat things I don't hear	Mind reading	I don't really know what people are thinking. If they are my friends, they will tolerate my occasional difficulty hearing
I am bound to have a miserable day when I hear my tinnitus first thing in the morning	Jumping to conclusions	I can't accurately make that prediction. What if I win the lottery that day?
My tinnitus makes me feel hopeless, there is no hope	Emotional reasoning	Other people have survived tinnitus, I can too
Because of my tinnitus I was awake all night. Every night is the same.	Overgeneralization	I have had some nights when I get a decent sleep, also I wasn't truly up all night, I did get a few hours
I didn't think much about my tinnitus today, but that was a fluke	Disqualifying the positive	The fact that I didn't think about my tinnitus today is an indication that I can do other things in spite of the tinnitus

My tinnitus is louder, I must be going deaf	Catastrophizing	There is no evidence to suggest this
I should never have listened to rock music, I did this to myself	Should statements	What's done is done, I can't go back in time. I have to move forward.
I ruined everyone's evening because I was miserable	Personalization	Other people's enjoyment is not solely determined by me. They have their own thoughts, feelings, and actions.
Having tinnitus (and hearing loss) makes me a disabled person	Labeling	I am not disabled, I can still do a lot of good things despite my loss

NOTE: It is not essential for the person to initially believe the alternative thought, only to acknowledge that it is a possible option.

It is also important for persons with tinnitus to analyze their negative thoughts for accuracy. That is, to distinguish between the tinnitus experience and the maladaptive behavior.

A person may assign the blame for certain behaviors on the presence of tinnitus. He may say "the tinnitus is making me depressed", or the "tinnitus is preventing me from working". These statements confer attributes to tinnitus that are unwarranted. The person must recognize that the tinnitus does not have the power to produce such events. It is the person's reaction and behaviors that produce these responses. The hearing care professional can help the person remove tinnitus' status as an entity of its own by encouraging them to analyze the reality and logic of their statements.

The person can chart perceived problems and then provide a more accurate assessment. A sample chart might be similar to the following:

Perceived problem	Realistic assessment
My tinnitus keeps me awake all night	I fall asleep relatively easily but then I awaken twice each night and it takes about an hour to fall back asleep
The tinnitus drives me crazy	I am finding it difficult to concentrate when I can't find any quiet time and I am frustrated, but I am not crazy!
Tinnitus is ruining my life	I am really stressed because I don't have enough time to juggle work, family and leisure, and I tend to blame the tinnitus for my problems

If the person with tinnitus persists in maintaining maladaptive thoughts, it may be helpful to politely, but firmly, challenge the negative thoughts by asking questions such as:

- what evidence do you have to back up your statement?
- are you considering all the facts?
- might you be misinterpreting anything because of unhelpful thoughts?
- are you exaggerating?
- have you considered all possible alternatives?
- is there anything you might do about these situations?
- what is the worst thing that might happen?
- how likely is it that the worst thing will happen?
- what is most likely to happen?

4. Identify maladaptive behaviors and list alternative solutions.
   This also can be done face to face with the person or via a homework assignment using a worksheet as follows:

Maladaptive behavior	Alternative strategy
When I hear my tinnitus in the morning, I stay in bed all day, avoiding sound, and feeling depressed	Being active makes me think less about my tinnitus. I should go to a mall, put on other sounds in my house so that the tinnitus isn't so apparent, and do anything except nothing!
I have trouble falling asleep so I lay in bed worrying about how I will feel tomorrow	If I can't sleep in 30 minutes, I will get up and read on the sofa, or will watch some quiet TV show, or get some extra work done that I have been putting off
When my tinnitus is loud, I get angry with my family	It is not my family's fault when my tinnitus bothers me. It would be a positive step if I can distract myself by engaging in activities or conversations with them. And if I really don't want to be around anyone, I could excuse myself and listen to some relaxing music (or take a shower). Most importantly, I shouldn't take out my anger on someone else.

Not all of the worksheets described above are necessary for each person. Tailor the CBI to the needs of the person based on that person's maladaptive thoughts and behaviors. Excellent guides for employing cognitive-behavioral intervention with people suffering from tinnitus can be found in "Living with Tinnitus and Hyperacusis" by McKenna, Baguley and McFerran, (2010) and in "The Psychological Management of Chronic Tinnitus" by Henry and Wilson (2001).

The integration of cognitive behavioral intervention is best implemented when combined with strategies to enhance one's ability to relax and reduce stress. Tools to achieve this will be described later in this manual.

Amplification

As described earlier, hearing aids can be very effective in decreasing the perception of tinnitus because 1) the increased stimulation sent to the cochlea and ultimately the auditory cortex can minimize the brain's attempt to "overcompensate" for the lack of stimulation by turning up its sensitivity, 2) They may mask or partially mask tinnitus, and 3) They may reduce contrast between tinnitus and silence.

While most well fitted, high quality hearing aids can help tinnitus sufferers with hearing loss, Widex hearing aids are particularly effective because of their low compression thresholds, broad bandwidth, precision fitting procedure (Sensogram), and in situ verification (SoundTracker).

Compression Threshold (CT)

Many tinnitus treatments advocate the avoidance of silence. Indeed, people frequently notice their tinnitus most when they are in quiet environments. Here is a good example to use with the person. "This is similar to the experience of being in a dark room with a candle on (such as when you attend a birthday party). Your eyes involuntarily go directly to the candle because it is the spot of greatest contrast. Once the lights are turned on, your eyes go wherever you direct them to go. Figure 5 shows an illustration of how contrast draws attention. With tinnitus, if you are in a quiet environment, your attention may be attracted to the one "sound" you perceive, that is, the tinnitus. Therefore, in order to minimize these situations, maintaining some background sound is advisable. However, with certain hearing aids whose CT is as high as 45-60 dB, no stimulation will be sent to the ear (and brain) if there is little or no background sound in the environment. Widex hearing aids have the lowest CT in the industry, thereby producing the most gain for the softest inputs. Therefore, if the person suffering from tinnitus is in a quiet environment, rather than perceiving silence, the hearing aid will provide amplification to reduce the contrast of the tinnitus to the background environment.

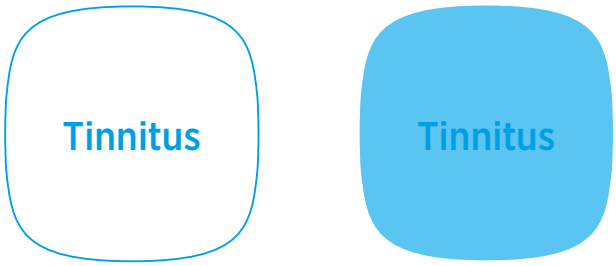

Figure 5: Example of how contrast alters perception

Bandwidth

Given the fact that tinnitus is typically most pronounced within or near the frequency range of the hearing loss, and it is widely accepted that at least part of the reason for experiencing tinnitus is due to the brain's attempt to overcompensate for the lack of sound from the impaired auditory system, it makes sense to amplify sound in the entire hearing loss region. Also, most, though not all, tinnitus tends to be matched at 3000 Hz and higher. Therefore, it is best to utilize hearing aids that amplify the broadest bandwidth possible. We recommend that you select a Widex hearing aid with the broadest bandwidth to provide high frequency input to the auditory system.

Sensogram

In order to provide stimulation to the cochlea and auditory cortex, it is necessary to ensure that amplification is actually being received at the eardrum. Therefore, it is essential to obtain an in-situ measure. It is not enough to merely trust the NOAH screen because the data shown simply reflects the manufacturers' concept of amplification for the "average" ear. The Widex Sensogram ensures that the settings programmed into the hearing aids actually are perceived by the listener. In addition, you should choose to perform an expanded Sensogram when there is hearing loss at inter-octave frequencies, a sharply sloping hearing loss (differences in threshold between frequencies of more than 10 dB), or if the tinnitus pitch match occurs at frequencies other than 500, 1000, 2000, or 4000 Hz.

Other fitting considerations for people suffering from tinnitus

- Earmold coupling: keep the ear canal as open as possible taking the individual hearing loss and the fitting range of the hearing aid into account.
- Expansion: expansion minimizes gain for soft inputs, so it essentially has the opposite effect of having a low compression threshold. Therefore, expansion is not optimal for people with tinnitus.
- Noise reduction: Widex' adaptive noise reduction is only active at poor signal-to-noise ratios and is designed to manage noise occurring at relatively high intensity levels. It can therefore be useful for comfort, and may provide psychological reassurance to the person who is concerned about potentially deleterious effects from noise exposure and amplification.
- Multiple programs: The availability of multiple programs is often beneficial for persons with tinnitus; some programs can be set to maximize speech perception, some for listening to music, some to maximize tinnitus reduction, some to maximize relaxation; and some to incorporate one or more of these objectives.
- Sound Diary: Logging the actual use of the hearing aid allows you to discuss the person's actual wearing pattern when he or she returns for follow up.
- Maximum output and IG loud settings: since many people with tinnitus have loudness perception disorders, including fear of excessive loudness, setting the maximum power at a level below the individual's personal loudness discomfort level is important. Measurement of LDLs was described earlier and is advisable; however, if you don't measure these, and if the person indicated during the interview or on the Questionnaire that loudness is a problem, reduce the prescribed maximum power slightly in the MPO manager screen. Be careful not to adjust these too low, however, as too low of a setting may make amplified sounds, including speech, seem "muffled" or distorted. In addition, consider reducing the IG loud setting by a few dB.
- Feedback management: similar to the discussion on maximum output, high intensity levels may be generated during the feedback test, especially when the hearing loss is moderate to severe. This may create discomfort for some people. In addition, some might feel their tinnitus gets worse. Be certain to ask persons about their loudness tolerance during the initial interview and when possible, measure their UCL prior to performing the feedback test. If this is a concern, simply bypass this test and allow Compass to set the default. Then afterwards, adjust the IG loud and MPO settings to avoid amplified sounds being too loud.
- Acclimatization: if loudness concerns persist, consider adjusting acclimatization settings.

<u>Binaural fitting considerations:</u>

- **If tinnitus and hearing loss are present in both ears:** Use binaural amplification. Monaural amplification may draw attention to the tinnitus in the non-amplified ear.
- **If tinnitus is present in one ear and hearing loss in both ears:**
  Use binaural amplification. Previously undetected tinnitus may become apparent in the unamplified ear when it is suppressed in the amplified ear. In addition, an unpleasant imbalance in hearing may occur if only one hearing aid is used.
- **If tinnitus is present in both ears and hearing loss in only one ear:**
  The person may benefit from binaural devices, but turn off the microphone in the normal hearing ear when Zen+ is selected. This arrangement will still allow the person to obtain the dichotic fractal tone experience (and will ensure stimulation of both cortical hemispheres).
- **If tinnitus is present but hearing is not sufficiently impaired to warrant hearing aids:**

The person may benefit from binaural devices with the Zen+ option. Use an open fitting and turn off the microphone in Zen+ so outside sounds are not being amplified.

- **If tinnitus and hearing loss are present in only one ear:**
  Use binaural hearing aids. Select Zen+ and turn off the microphone in the normal hearing ear. Leave the fractal tones on in both ears to stimulate both hemispheres.

A note of caution: Persons with tinnitus should be advised that while some might notice an immediate improvement in tinnitus, for many, habituation and stress reduction require a longer period of time. Therefore, it may be prudent to inform the person that unless there is an increase in tinnitus lasting for more than a few days (brief increases in tinnitus perception are not uncommon as the brain tries to preserve the tinnitus status quo), the amplification regimen should be maintained as prescribed. Patience is required before the full effects of the Widex Zen Therapy will be achieved.

Zen fractal tones

As described earlier, tinnitus and stress are highly correlated. When stress increases, the perception of tinnitus increases, and when tinnitus increases, stress increases. Thus, there is a vicious cycle for which any disruption might be beneficial. The use of music for setting and altering moods, including arousing, calming, and relaxing, is not new. Music is commonly used in homes, work environments, celebrations, advertisements, romances, movies, shopping malls, and hospitals. Listening to music can result in physiological changes correlated with relaxation and stress relief. Music is believed to be helpful in reducing stress because of the wide range of neural structures that are activated including the cerebellum, frontal lobe, limbic system, and auditory cortex. Patterns of musical elements, such as slower tempo (60-70 beats per minute), lower pitch, degree of repetition, and lack of emotional content, have been established as having a calming, rather than alerting effect.

Music affects people in different ways, due to inherent and learned preferences. Research has shown that the use of previously recorded music may have restrictions on stress reduction because familiar music can evoke memories and potentially negative emotions and create unwanted distraction. Active listening may have a tendency to arouse some people, however, so when possible, it may be preferable to use a passive listening approach to capitalize on the natural ability of the brain to habituate to a non-salient, non-threatening stimulus. In addition, few people have the luxury of actively engaging in an active therapeutic approach, particularly one that requires use of visible earphones, for much of their waking and working hours. Thus, it can be argued that the use of music for subconscious relaxation and reduction of stress, as may be present in tinnitus, should not be actively distracting. And, since there are personal preferences, neutral music should not have emotional associations.

An alternative approach to pre-recorded music that incorporates the benefits and rules of music but avoids these potential limitations is the use of fractal tones. Fractal technology (Zen tones) ensures that no sudden changes appear in tonality or tempo. They repeat enough to sound familiar and follow appropriate rules, but vary enough to not be predictable. The tones (which sound somewhat like wind chimes) are thus pleasant, but are not associated with music that the listener may hold in memory, and incorporate the properties of music that have been proven to be most relaxing. By filtering these sounds in accordance with an individual's hearing loss, and delivering them in an inconspicuous manner via high fidelity hearing aids both hearing needs and stress management can be addressed.

Introducing Zen

Before the selection of the appropriate Widex hearing aids is made for the person suffering from tinnitus, the concept of Widex Zen Therapy should be reviewed.

- The person should be reminded about the relationship between tinnitus and hearing loss, and the relationship between tinnitus and stress.
- The use of background sounds to stimulate the brain should again be explained.
- The effect of music and relaxation exercises to combat the stressful effects of tinnitus should be reiterated.
- Explain why unfamiliar but pleasant background musical tones filtered to accommodate the person's own hearing loss can be more effective in inducing passive listening and habituation than familiar music.

In general the selection of the style and model of the hearing aid for Widex Zen Therapy should be based, firstly, on the requirements of the hearing loss, and secondly with a view to the widest possible frequency response. Also make sure that the chosen model has Zen+ as an option and that a volume control and a program button are accessible either on the hearing aid or via a remote control.

All people with tinnitus are candidates for Widex Zen Therapy. There are some hearing impaired persons with no negative reactions to tinnitus who may require only basic counseling and the use of quality hearing aids. But since they are going to get hearing aids,

	Default pitch				Tonality		Dynamic range		Default tempo		
Fractal styles	**Low**	**Medium low**	**Medium high**	**High and reverberant**	**Major**	**Minor**	**Restricted**	**Broad**	**Slow**	**Medium**	**Fast**
Aqua	●				●		●		●		
Coral			●			●		●	●		
Lavender			●		●			●			●
Green				●	●		●			●	
Sand			●		●			●			●

Figure 6: The pitch, tonality, dynamic range and default tempo of the five Zen styles.

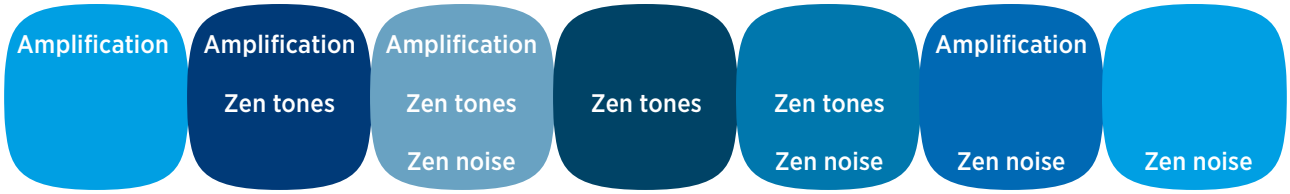

Figure 7: Different combinations of amplification, Zen tones and Zen noise give a total of 7 possible options.

anyway, always include the Zen option. Some people may decide they don't like or need the fractal tones or noise initially, but even these persons may change their minds later. It also may be very useful to demonstrate the Zen sounds to people. It is best to do this through headphones or through a pair of Widex hearing aids. Some hearing care professionals simply present the Zen tones through loudspeakers. The limitation of this however is that the person 1) won't get the true stereophonic dichotic effect and 2) the sounds may not be adequately filtered to meet their hearing needs. When demonstrating Zen, present the sounds at an audible, but soft level. Even if the tinnitus is not bothersome to these people, they may find the Zen tones provide a simple means of reducing the contrast of tinnitus to silence and creating a relaxing acoustic atmosphere.

Programming Zen

There are five available Zen tone styles. Each of them can be further adjusted for tempo, pitch and volume. The basic spectrum and intensity level will be based on the Sensogram, so you don't need to make extensive initial settings.

Having choices has been proven to be important in a series of experiments at Widex and multiple universities. The five Zen styles differ in terms of pitch, tonality, dynamic range, and tempo and are shown in Figure 6.

In addition, a broadband noise option is available that can be used either with the Zen tones, or alone. Also the Zen signals and noise can be played with the hearing aid microphone on or off. Figure 7 illustrates the different combinations of Zen, amplification, and noise.

Basic Widex Zen Therapy fitting

When fitting the Zen programs for Widex Zen Therapy we recommend that you start out by doing a basic fitting which fulfills the needs of most persons suffering from tinnitus. The recommended basic fitting incorporates:

a. Zen Aqua + mic for all day sound stimulation
b. Zen Aqua + noise + mic for all day sound stimulation in periods where tinnitus is more bothersome
c. Zen noise + mic, which might be found effective in reducing tinnitus awareness early in therapy.

Follow these steps for the basic fitting:

1. After you have completed the Sensogram and the feedback test, go to the Program manager.
2. The Master program adjusted to best address the hearing loss is placed in Program slot 1 (P1). Select the Zen+ option and press the arrow. Press OK.
3. Go to Fine tuning and select Zen+ in the Program starter.
4. Use the pull down menus and select Zen aqua (the most commonly preferred) in slot A.

5. Use the pull down menu and select Zen aqua in slot B. Go to settings and select noise.
6. Use the pull down menu to select Zen noise in slot C.
7. Use the play-button in slots A, B and C and verify if the volume level is adequate. If not, go to settings and adjust the tone and noise volume levels.
8. When the fitting is completed, instruct the person to access Zen+ by making a long key press either on the hearing aid program button (if it has one) or on the remote control program shift button. Also instruct the person to adjust the volume of the Zen tones or Zen noise by using the volume control on the hearing aid (if it has one) or on the remote control. (The default setting of the volume control in Zen+ is that the person's volume adjustments adjust the Zen tones and noise independently of amplification).
   Attention: If the person does not need amplification: Set the Sensogram to a flat 10-15 dB hearing loss, and turn off the microphone in all the Zen+ programs. Go to settings in Compass fitting software and turn up the noise level to its maximum.

Remember to verify that:

- **The Zen tones are audible, but relatively soft**
- **The Zen tones do not interfere with conversational speech**
- **The volume of the Zen tones is set so that the annoyance level of the tinnitus should just begin to decrease**

The greatest success with persons suffering from tinnitus will often be attained when the hearing care professional exercises flexibility in order to fit the individual person's needs. Some persons will for example demonstrate a clear preference for a different tempo or pitch, which can easily be adjusted. Some people may also need individual changes in their Zen+ program set-up. See the advanced fitting section below for general guidelines.

Advanced Widex Zen Therapy fitting

If the person does not like the Aqua Zen style:

1. Use the Zen style library and let the person listen to the five different default Zen styles for approximately 30 seconds each.
2. Ask the person to decide which style is most relaxing and produces the least tinnitus awareness. The criterion is NOT which style has the best sound or most pleasant rhythm (because we don't want the person to actively listen to the sound in daily life). To help the person choose, provide a dual 6 point scale (see below) with 6 representing the style that produces the least tinnitus awareness and is most relaxing.
3. Select the style which is most relaxing and produces the least tinnitus awareness and add in slot A. Select the same style in slot B and add noise.
4. If you wish, together you can further individualize the Zen styles by adjusting the tempo, pitch and volume.
   a. Go to settings and adjust tempo and pitch until you match the person's preferences. Use the play button and let him listen to the adjusted Zen style for at least 10 seconds.

If the person needs a relaxation program

1. Slot C can be used as a relaxation program, where the microphone is turned off in order to provide active listening. Zen aqua (or other Zen styles) or Zen noise can be chosen depending on the person's preference.
   a. Go to slot C and select the person's Zen preference
   b. Go to settings and deselect the microphone

If the person needs a sleep program

1. Slot C can be used as a sleep program, where the microphone is turned off and limited play time is activated to help manage sleep problems. Zen Aqua (or other Zen tones) or Zen noise can be chosen depending on the the person's preference.

Zen Style	Tinnitus Awareness Score (6 = least awareness of tinnitus, 1 = most awareness of tinnitus)	Relaxation Score (6 = most relaxing, 1 = least relaxing)
Aqua		
Coral		
Lavender		
Green		
Sand		
Noise		

a. Go to slot C and select the person's Zen preference
b. Go to settings and deselect the microphone
c. Select limited play time and use the drop down list to select the playtime duration based on the person's needs.

If the person needs more than three Zen programs

1. In general we recommend using the Zen+ option to make it easier for the person to associate a long push on the program button with activating their tinnitus program.
2. Some people might however need more than three Zen programs, especially in cases where they suffer from a severe tinnitus reaction. Additional programs can be added in program 2 and program 3 of the hearing aid. You can also use these slots to select various combinations of microphone on or off, noise on or off with and without different Zen styles.

When (and how) to use each option

Tinnitus sufferers should be instructed to have a Zen program turned on all day. Thus, the default program for them should be the first or second slot in Zen+. Many people find the noise to be effective in reducing tinnitus awareness early in therapy, but may deselect it later, if they so choose.

People should be discouraged from making frequent changes to the volume of the programs. Basically, they should set it and forget it. There may be situations, however, when they either want the microphone off (for quiet relaxation – and this is the only time when active listening is allowed) or the Zen tones or noise off (for critical hearing periods). However, under normal circumstances, the Zen tones should not interfere with speech perception because the Sensogram establishes a default volume of the tones. Due to a very restricted dynamic range, tinnitus sufferers with more severe hearing loss might need to turn to the Master program (P1) in situations where hearing and communication are essential.

People who initially do not like the Zen tones, or feel they interfere with their ability to concentrate or understand speech, should be instructed to turn the Zen on for a few hours a day (the time can be broken up into shorter periods, but never for less than 15 minutes) for the first two weeks, with the understanding that if they still don't like it after two weeks, it will be turned off. People should always use the Zen tones or Zen noise when their tinnitus is highly bothersome.

One additional point should be made. It is widely believed that the central nervous system increases its internal gain when it is cut off from expected stimulation. In addition, the perception of tinnitus is most prevalent (for most persons suffering from tinnitus) in quiet environments. Therefore, it is highly recommended that persons with tinnitus should be instructed to avoid silence as much as possible when they are engaging in their quest to habituate to tinnitus. When not wearing hearing aids or being exposed to the Zen option, they should maintain some extent of sound stimulation, which may take the form of background sound from radio, TV, or a fan.

Relaxation strategy program

The fourth component in the integrated Widex Zen Therapy is the use of relaxation exercises. The Zen acoustic signals will provide the listener with a relaxing background, but if the person with tinnitus is going to truly break the vicious cycle of tinnitus and stress, proven relaxation exercises should be used. Therefore we suggest that each person who has a negative reaction to tinnitus or who demonstrates the need for stress reduction (and that includes most people) be prescribed and taught relaxation techniques. These exercises should be demonstrated and then instructions provided for the person to take home and read. While there are numerous good relaxation techniques, we will focus on three simple but effective procedures, each of which only requires 5-10 minutes. Remind the person with tinnitus that the Zen Therapy is designed to address not just the acoustic aspect of the tinnitus, but the emotional and attention as well. Use of these exercises has been shown to release neurotransmitters that aid in focus, concentration, and stress relief. People suffering from tinnitus should be instructed to give themselves the gift of relaxation for 15 minutes each day. Within two weeks, most of them will notice a difference in their overall sense of well-being, an important step in dealing with tinnitus.

General suggestions for the relaxation exercises:

- Perform the exercises while sitting in a comfortable chair in a quiet place with no distractions.
- Do the exercises while listening to the Zen tones, but if you are too distracted, turn off the tones.
- Remove your shoes and wear loose, comfortable clothing.
- Don't worry if you fall asleep though, of course, that is not the purpose.
- After finishing the exercise, close your eyes, relax for a few minutes, breathe deeply and rise up slowly.

Note: inform the persons that if they have any medical conditions that may cause discomfort, they should ask their physician before doing these exercises.

Methods

- Progressive Muscle Relaxation (PMR)
- Deep breathing
- Guided imagery

Progressive Muscle Relaxation:

PMR consists of alternating deliberately tensing muscle groups and then releasing the tension. Focus on the muscle group; for example, your right foot. Then inhale and simply tighten the muscles as hard as you can for about 8 seconds. Try to only tense the muscle group that you are concentrating on. Feel the tension. Then release by suddenly letting go. Let the tightness and pain flow out of the muscles while you slowly exhale. Focus on the difference between tension and relaxation.

The idea is to progress systematically starting with your head and progressing all the way down to your feet. Here is a progression you can follow (or you can minimize the number of groups by including several adjacent body parts together):

- head (facial grimace)
- neck and shoulders
- chest
- stomach
- right upper arm
- right hand
- left upper arm
- left hand
- buttocks
- right upper leg
- right foot
- left upper leg
- left foot

Relax for about 10-15 seconds and repeat the progression. The entire exercise should take about 5 minutes.

Deep breathing:

This is the simplest of the relaxation procedures. It simply requires you to follow the five suggestions above and to add deep, rhythmic breathing. Specifically, you should complete the following cycle 20 times:

- Exhale completely through your mouth.
- Inhale through your nose for four seconds (count "one thousand one, one thousand two, one thousand three, one thousand four").
- Hold your breath for four seconds.
- Exhale through your mouth for six to eight seconds.
- Repeat the cycle 20 times.

The entire process will take approximately five to seven minutes.

Guided imagery:

After achieving a state of relaxation via PMR and deep breathing, keep your eyes closed and continue the deep breathing while imagining yourself in the most relaxing environment possible (perhaps lying on the beach, floating in the water, or floating on a cloud). Try to imagine, with all your senses, the feel of the air on your skin, the smell of the fresh ocean or forest, the taste of your favorite beverage, and either listen to the Zen tones, or make up your own imaginary pleasant sound, like ocean waves, a babbling brook, or the crackling of a warm fire.

When finished, count backwards from 20 and slowly rise up.

Managing sleep problems

One of the most common problems expressed by persons with tinnitus is difficulty falling, or staying, asleep. It is important to address these issues, as they will have an effect on the person's ability to learn to cope with tinnitus. Sometimes, however, people have unrealistic expectations or an unrealistic estimate of their sleep issues. Keep in mind that adults average eight hours of sleep and that sleep requirements sometimes change as one gets older. It is important to rule out medical conditions contributing to sleep problems, such as apnea or depression, and if such conditions are suspected, refer to a sleep clinic or sleep specialist. Also, realistically discuss the use of sleep medications. These can be very important, particularly in the early stages of dealing with tinnitus. You can also help the person by providing him with a list of suggestions including:

- Maintain a standard bedtime for each day.
- Set your alarm for the same time each day.
- Walk or exercise for ten minutes a day, but not right before going to sleep.
- Set your thermostat for a comfortable bedroom temperature.
- Use a fan or white noise machine to interfere with your tinnitus.
- Close your curtains/drapes and maintain a bedroom dark enough to sleep.
- Change the number of pillows you use. This also may impact somatic contributors to tinnitus.
- Don't watch TV, eat or read in bed. Use your bed for sleep and sex.
- Sleep on your back or on your side, try to avoid sleeping on your stomach.
- Take prescription medicines as directed, but only if required.
- Have a set pre-bedtime routine. Start relaxing as you go through your routine.
- Take a warm bath as part of your bedtime routine.
- When you go to bed, take a deep breath and just relax. Feel your muscles relax.

- Once you're in bed, focus on a pleasant experience and use it like a mantra. Use the same thoughts each night.
- Don't engage in any activities before bed that stimulate your body or your mind. For example, planning a big speech, watching a favorite TV program, or participating in a hobby activity.
- Avoid food and drinks that contain caffeine. Caffeine is present in many sodas, coffee, tea, hot chocolate, and chocolate candy.
- Don't take a late afternoon or early evening nap. If you find yourself extremely tired in the afternoon, take a brisk walk, instead of a nap.
- Don't drink alcohol within an hour or two of going to bed.
- Don't lie awake for more than half an hour. If you find yourself wide awake, do some other quiet activity away from the bed and bedroom. Go to bed only when you're relaxed and ready to sleep. This reduces the time you are awake in bed.

Using Zen for sleep

The Zen acoustic signals provide people with a relaxing background and might be helpful for their experiencing difficulties falling or staying asleep. Fit the hearing aids with the person's preferred Zen tone program (microphone off) in Zen+ slot C with limited play time (depending on the person's needs). After the selected time the tones automatically stop playing. Some researchers believe that the auditory system is still active even during sleep. While there are no definitive data supporting tinnitus improvements from nighttime stimulation, it is possible that some changes can occur. Persons who experience sleep difficulties, might therefore attempt to utilize Zen all night through – for these persons limited play time should not be activated. It is important to ensure the comfort and safety of wearing hearing aids while sleeping. Since the microphone is turned off, it may be reasonable to provide a different, more open, earmold coupling system that persons can utilize for sleep conditions. Test the comfort of the hearing aid and earmold in your office by letting the person rest against a pillow.

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DETERMINING COMPONENTS FOR INDIVIDUALIZED WIDEX ZEN THERAPY

There are basically three different types of people with tinnitus for whom Widex Zen Therapy may be appropriate:

1. People for whom hearing loss is the main focus and tinnitus is secondary and is not causing significant emotional distress.
2. People for whom tinnitus is the main focus, but it is not causing significant emotional distress.
3. People for whom tinnitus is the main focus and is causing significant distress in their lives.

For those persons (# 1 and 2 above) fortunate enough to not have emotional distress from their tinnitus, it may be sufficient to provide:

- simple reassurance
- basic instructional counseling about the cause and likely course of the tinnitus
- hearing aids, when the amount of hearing loss warrants amplification and Zen option for quiet environments

For those persons however, that do have significant emotional distress, that is, their reaction leads to increased attention, emotional, motivational, and behavioral distress, they will require more extensive management of their attitudes and behaviors. For these persons, more (or possibly all) of the components of the Widex Zen Therapy are appropriate.

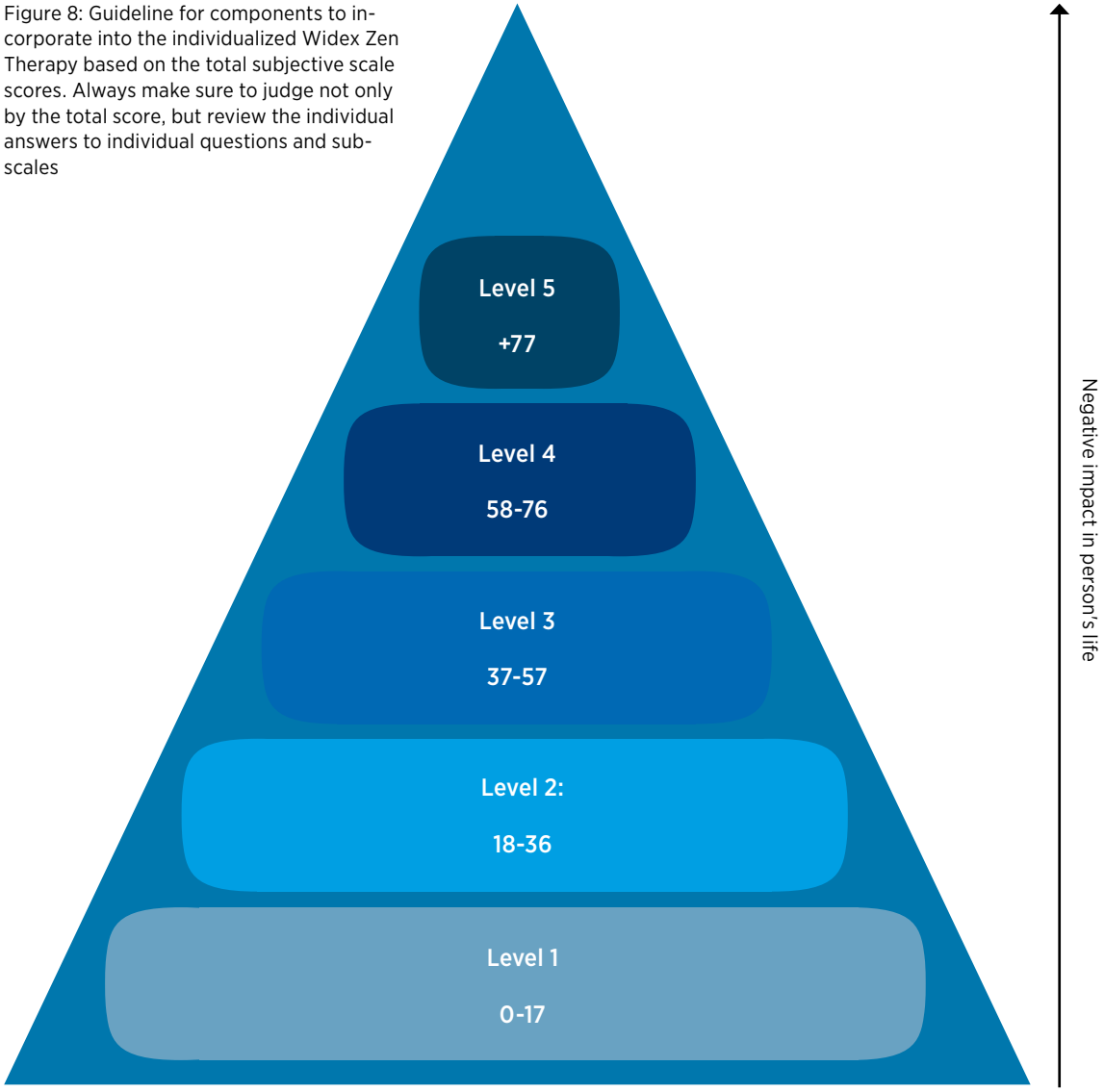
- Extensive counseling
- Cognitive-behavioral intervention
- Amplification/avoidance of silence
- Zen option (fractal tones and / or noise) for passive listening
- Relaxation exercises

It is often apparent from the personal interview and/or the Intake questionnaire which of the Widex Zen Therapy components are needed. However, as a guideline, or if you are not certain, you can use the person's baseline subjective scale (TFI, THI, TRQ, THQ) scores to create the individualized intervention plan.

Figure 8 provides a general guideline using the subjective scale score to help determine which components to incorporate. Keep in mind that this is just a guideline and that there is substantial overlap between the cut-off scores and classifications. Therefore the decision regarding which components are needed should be primarily based on the specific responses from the Intake questionnaire and interview. For example, persons with a very mild negative reaction to their tinnitus may still comment that stress increases their tinnitus perception, and therefore, relaxation exercises may be beneficial.

See case histories at the end of this part of the manual for examples on how to use the total subjective scale score as a guideline for determining the components of the individual person's Widex Zen Therapy.

Figure 8: Guideline for components to incorporate into the individualized Widex Zen Therapy based on the total subjective scale scores. Always make sure to judge not only by the total score, but review the individual answers to individual questions and subscales



Level 5: Catastrophic tinnitus reaction with or without hearing loss
Instructional and adjustment based counseling, cognitive behavioral intervention, amplification/avoidance of silence, Zen all day, relaxation exercises 2-3 times a day

Level 4: Severe negative tinnitus reaction
Instructional and adjustment based counseling, cognitive behavioral intervention, amplification/avoidance of silence, Zen all day, relaxation exercises

Level 3: Moderate negative tinnitus reaction
Instructional and adjustment based counseling, cognitive behavioral intervention, amplification/avoidance of silence, Zen all day, (relaxation exercises might be useful)

Level 2: Mild negative tinnitus reaction
Instructional and adjustment based counseling, amplification (when hearing loss exists), Zen for quiet environments, (relaxation exercises might be useful)

Level 1: Minimal or no negative tinnitus reaction
Basic counseling about the cause and likely course of tinnitus, amplification (when hearing loss exists), (Zen might be useful for quiet environment)

ESTABLISHING REALISTIC, TIME-BASED **EXPECTATIONS**

Just as it takes time for all of the physical changes in the brain and behavioral and attitude changes to occur after first noticing hearing loss and tinnitus, it takes time for the positive effects to occur. The complete effects of the Widex Zen Therapy may NOT be immediate though many will report an immediate (though possibly temporary) emotional improvement following your counseling and a reduction in the annoyance of the tinnitus perception upon first being fit with hearing aids. The objective in the therapy is an "overhaul" of the person's attitude and ability to cope with tinnitus (and of course, habituation). For these to occur, time and patience are required. For some, the process is completed in a few months, for others, it may literally take up to two years. The important point is to emphasize that this is a journey and that the person is best served by maintaining an even temperament despite apparent fluctuations (improvement or worsening) in the loudness or quality of the tinnitus.

ASSESSING **PROGRESS**

The criteria for determining whether the person is progressing are based on improvement of quality of life and reduction of negative thinking about the tinnitus, but NOT on changes in the perceived loudness of the tinnitus. Progress is best quantified by comparing the baseline subjective score to current scores. Therefore, it is recommended to have the person fill out these scales before therapy begins, and at two weeks, one month, three months and 6 months following the beginning of therapy. This can be done during appointments or by mail.

Other things the tinnitus sufferer can look for:

- An overall reduction in the time spent feeling bad about having tinnitus; for example, if the person originally reported on the intake questionnaire to think about the tinnitus 90% of the time, it is a definite improvement if they indicate now only thinking about it 60% of the time.
- An increase in the intervals between episodes of thinking negatively about the tinnitus; if the person initially indicates that not more than one hour passes between episodes of thinking about the tinnitus, but now claims there are times when he or she doesn't think about it for several hours at a time, that is improvement. On this matter, suggest to the person that any time he does begin to think about the tinnitus, it means that he wasn't thinking about it a moment earlier. This may help frame the negative time spent more accurately.

FOLLOW-UP SCHEDULE

The requirement for follow-up services is typically higher for people with tinnitus than for people with hearing loss alone. These follow-up consultations are very important because there is likely to be peaks and valleys in progress and it is crucial to reassure them of your professional support. They should be phoned 2-3 days after the fitting, further appointments (which should be scheduled at the time of the fitting) should be confirmed during which the TFI, THI, THQ or TRQ (whichever was used for baseline measures) is administered, progress is reviewed, all phases of the Widex Zen Therapy, that is, cognitive behavioral homework, hearing aid usage (which can be monitored via the data logging feature in Compass), fractal tone usage, and adherence with the relaxation exercises, are discussed. In addition, of course, consultations will be important to answer ongoing questions and make necessary adjustments.

A reasonable follow-up schedule should include appointments following the initial fitting at 2 weeks, 1 month, 3 months, 6 months, and one year.

WIDEX ZEN THERAPY IN A NUTSHELL: A **SIMPLIFIED COOKBOOK APPROACH**

The overall objective of Widex Zen Therapy is to ensure that the tinnitus does not negatively impact the person's quality of life! In other words, it is not designed to be a cure, or to suppress tinnitus (though it sometimes produces that effect).

Components of Widex Zen Therapy

1. Counseling (both instructional and adjustment based) designed to educate the person and assist the limbic system to alter its negative interpretation of the tinnitus. For some people Cognitive Behavioral Intervention might be needed.
2. Amplification, which is state-of-the-art, to binaurally (when appropriate) stimulate the ears and brain in order to discourage increased central activity (overcompensation) and maladaptive cortical reorganization.
3. Fractal tones, a novel, proven acoustic stimulus delivered dichotically to the person in a discreet, inconspicuous and convenient manner, designed to both relax and provide acoustic stimulation.
4. Relaxation strategy program highlighted by behavioral exercises.

Widex Zen Therapy is unique because it is an integrated program addressing all 3 components of tinnitus distress, auditory, attention, and emotion. People with tinnitus who have minimal or no negative reaction may not require all the components of Widex Zen Therapy. For example, some may be helped adequately with simple counseling and education. Others may require counseling and amplification containing the Zen option. But for those persons whose reaction to the tinnitus is severe and negative (as defined by the subjective tinnitus scales), an integrated program incorporating cognitive-behavioral concepts and relaxation exercises along with counseling and acoustic tools will produce maximum effectiveness.

Step by step process

Step 1: Administer the Intake questionnaires.

Use the Widex Zen Therapy intake questionnaire and the TFI or one of the other available subjective scales (TRQ THQ, or THI).

Step 2: Present basic counseling and provide reassurance and hope.

Provide an explanation of the relationship between tinnitus, hearing loss, and stress:

a. Hearing loss and tinnitus are closely connected, maybe because the brain overcompensates for what it is not getting from the ears. Tinnitus may therefore be a "normal" consequence of hearing loss.
b. Stress typically increases the perception of tinnitus and makes it more difficult to deal with. Anything we can do to help the hearing loss and relieve stress therefore has a beneficial prospect.

Define and describe habituation:

a. Most people who experience tinnitus go through a natural process of habituation. Habituation can be thought of as the process of becoming accustomed to a non-relevant stimulus without exerting any conscious effort.
b. Provide examples of habituation: not being aware of rings on our fingers, not being aware of the tactile sensation of clothing on our bodies and not being aware of the constant humming sound from a refrigerator or a computer.

Explain that the objective of the intervention is NOT to cure the tinnitus but rather is to address all the components that are involved in tinnitus distress. In other words,

a. to initiate and facilitate tinnitus habituation by helping the brain reclassify the tinnitus as a non-relevant stimulus;
b. to provide state-of-the-art amplification to stimulate the brain, thus allowing it to not attempt to overcompensate for the hearing loss; and
c. to increase relaxation skills using a scientifically validated form of music combined with relaxation exercises to reduce stress and provide sleep management suggestions, when necessary.

Step 3: Select appropriate Widex hearing aids.

The hearing aids should have the broadest bandwidth to provide input to the auditory system, the Zen+ option and access to program shift and volume control.

Step 4: Reiterate the rationale for using the Zen tones along with amplification.
That is, to provide relaxing, non-predictable acoustic stimulation to the brain to induce passive listening and habituation.

Step 5: Follow these steps for the Basic Fitting:
- After you have completed the Sensogram and the feedback test, go to the Program manager.
- The Master program adjusted to best address the hearing loss is placed in Program slot 1 (P1). Select the Zen+ option and press the arrow. Press OK.
- Go to Fine tuning and select Zen+ in the Program starter.
- Use the pull down menus and select Zen aqua (the most commonly preferred) in slot A.
- Use the pull down menu and select Zen aqua in slot B. Go to settings and select noise.
- Use the pull down menu to select Zen noise in slot C.
- Use the play-button in slots A, B and C and verify if the volume level is adequate. If not, go to settings and adjust the tone and noise volume levels.

Step 6: People with tinnitus should be instructed to have a Zen program turned on all day.
For people with tinnitus who initially do not like the Zen tones, or feel it interferes with their ability to concentrate or understand speech, instruct them to turn the Zen on for a few hours a day (the time can be broken up into shorter periods, but never for less than 15 minutes) for the first two weeks, with the understanding that if they still don't like it after two weeks, it will be turned off. Persons with tinnitus should always use the Zen tones or Zen noise when their tinnitus is highly bothersome.

Step 7: Remind the person to try to avoid silence as much as possible.

Step 8: Provide the person with written instructions for the relaxation exercises.
Give a brief demonstration. Also provide the person with the sleep suggestions.

Step 9: Remember that tinnitus management is a journey
Remind persons with tinnitus of the ups and downs to be expected.

Step 10: Follow up by phoning the person in a few days after the fitting, arranging further appointments
At these appointments you will again administer either the TFI or THQ, TRQ or THI, and review progress and make necessary adjustments.

To summarize
- Tinnitus sufferers with hearing loss may best be served by amplification that incorporates low compression thresholds, a broad frequency response, and flexible options for acoustic stimuli.
- Tailor the therapy to the person's functional needs.
- Sound therapy without counseling is not likely to work.
- If the persons require more counseling than you are able to provide, the Widex Zen Therapy contains counseling videos and other useful materials.

CASE EXAMPLES

Hearing loss with minimal tinnitus reaction

Mary, 60 years
Mary is an active, practicing lawyer with many clients. During the last year she has started to experience problems understanding clients, and is having difficulties following conversations in noisy environments. She also reports that she loves classical music, but she realizes that she can't hear the harmonics as well as she did in the past. She experiences occasional tinnitus when in silence but is not bothered by it. She schedules an appointment with an ENT physician and has her hearing checked. The hearing evaluation shows a moderate, bilateral high frequency hearing loss. She recognizes that the hearing loss is affecting her quality of life and arranges an appointment with a hearing care professional.

After the initial interview the hearing care professional recommends binaural fitting of hearing aids. Since Mary also mentions she is experiencing tinnitus some times, the hearing care professional asks her to fill out a TFI questionnaire. The TFI questionnaire reveals a score of 16, indicating a slight tinnitus reaction. Given the minimal nature of the tinnitus, the hearing care professional chooses to not focus on it and instead to focus on the hearing loss, but does alert her that frequently, hearing loss is accompanied by tinnitus and hearing aids often have the effect of reducing the perception of tinnitus in addition to helping communication.

Mary is fit with two Widex hearing aids with an open fitting and a remote control. An additional Zen program with the Aqua Zen style microphone on is placed into program 2. Mary is instructed to wear the hearing aids all the time using the master program for communication purposes. In very quiet situations where she experiences tinnitus, she is taught how she can use environmental sounds such as TV, radio etc. to reduce the contrast to silence, or how she can go to program 2 in her hearing aids and use the Zen program, if desired. The hearing care professional provides basic counseling about hearing aid use and maintenance, and the acclimatization process, and teaches Mary how to use the remote control.

At the first follow-up session two weeks after the fitting, Mary indicates that the hearing aids sound too sharp and that she is not able to use them all the time. She uses the volume control quite often. She has tried to go to the Zen program a few times, but doesn't really feel a need for it. The hearing care professional checks the Sound Diary and it is apparent how Mary reduces the volume a lot, and only wears the hearing aids a few hours per day. The hearing care professional fine-tunes the hearing aids, reducing the gain for high frequency sounds and provides additional counseling regarding the acclimatization process.

The second follow-up session takes place one month after the initial fitting. Mary is quite happy and satisfied with the hearing aids. The Sound Diary shows Mary is now using the hearing aids more than 6 hours per day and that she does not reduce the volume anymore. She still reports having challenges in noisy situations, but she is doing much better than before acquiring the hearing aids, and in fact would like even more amplification. She doesn't use the Zen program, because her tinnitus has been reduced by using the hearing aids. The hearing care professional adjusts the high frequencies using SoundTracker to ensure that sound is above her threshold. Mary indicates that she is pleased with the sound. The Zen program is removed and a music program is added instead since Mary appreciates listening to classical music.

The third follow up occurs three months after the initial fitting. Mary is still very happy with the hearing aids and she is using them all day. She reports being able to understand better in noisy environments, but that she still has some challenges. She indicates that the list of helpful hints she was provided with at the fitting is assisting her in those difficult situations.

Mary is told to set a new appointment if she feels the need for it.

Hearing loss with a mild negative tinnitus reaction

Jeanne, 40 years
Jeanne is a high school teacher. She has a very active social life and enjoys music and dance. She is experi-

encing increasing difficulties teaching, since she can't hear the students who are sitting far away from her. Sometimes the students tease her because she can't hear their questions or she misunderstands them. Additionally, she has started to notice tinnitus in both ears, slightly louder in the right ear. Her tinnitus is easily masked by environmental sounds and is frequently ignored during activities; however sometimes she is bothered by it. She schedules an appointment with her personal physician, and indicates that she has many relatives with hearing loss. Her doctor indicates that her hearing loss may be hereditary and he refers her for a hearing test.

Jeanne's hearing evaluation reveals a bilateral, flat moderate degree hearing loss. She is a bit resistant to the idea of wearing hearing aids, but she also realizes that the hearing loss is affecting her ability to teach and her overall quality of life. She relates a concern that her tinnitus, while not particularly bothersome now, could get worse and could affect her concentration and ability to hear. Jeanne receives basic counseling addressing the connection between hearing loss and tinnitus, and how hearing aids might impact tinnitus. A discussion is held regarding her feelings of being teased and concerns about how her tinnitus and hearing loss might affect her professional life. The hearing care professional reviews the copies of her family's audiograms that she requested upon receiving the referral letter from the ENT, for comparison purposes. The likely course of tinnitus and progressive hearing loss is discussed with her, and she is told that annual audiograms will help determine any progression and that in most cases, habituation, rather than progression of tinnitus is likely.

Jeanne is asked to fill out the Widex Zen Therapy intake questionnaire, and the TFI scale. The total TFI score was 28, indicating a mild negative tinnitus reaction. Given the mild reaction, the hearing care professional chooses to focus counseling on the hearing loss primarily, but she does alert Jeanne that frequently, hearing loss is accompanied by tinnitus and hearing aids often have the effect of reducing the perception of tinnitus in addition to helping communication. Additionally, the hearing care professional decides to add a Zen+ program in the aids to provide a soothing effect and help with habituation process.

Jeanne is fit with binaural BTEs with comfort vented custom earmolds and a remote control. The aids are programmed with a basic Master program as well as with a Zen+ program. The Zen+ consists of Zen aqua in slot A, Zen aqua + noise in slot B and Zen noise in slot C. Jeanne is satisfied with the sound quality of the hearing aids. She is told to wear the hearing aids several hours a day in the master program. She is also instructed to turn on the Zen+ program and to experiment with the 3 slots to determine which stimuli provide both relaxation and a soothing effect on her tinnitus. The hearing care professional explains that the main objective for the next two weeks, however, is for her to become accustomed to the amplification. Finally the hearing care professional provides basic counseling about hearing aid use and maintenance, and the acclimatization process. The use of the remote control and how to access the Zen+ is reviewed with Jeanne before she leaves the clinic.

At the first follow-up session, two weeks later, Jeanne states that she is very satisfied with the hearing aids and that she can understand her students and follows more conversations with other colleagues at work. Some sounds were a bit loud in the first week, but she has gotten used to them. Jeanne says that her tinnitus often is perceived in quiet situations and that it does not disappear with hearing aid use. She was not clear about when she was supposed to change to the Zen+ program, and therefore she has not used it very much. The Sound Diary shows that Jeanne has used the hearing aids about 8 hours per day and that the Zen+ only has been used for a very limited amount of time during the past two weeks. No fine-tuning is performed. The hearing care professional provides instructional counseling and because the hearing care professional has somewhat limited experience dealing with tinnitus sufferers, provides her with the tinnitus counseling videotape addressing the hearing loss and the tinnitus; she reiterates the causes of tinnitus, tinnitus distress and the habituation process in relation to tinnitus. The hearing care professional instructs Jeanne to turn on Zen aqua (slot A) when she is in quiet situations to reduce the contrast between the tinnitus and the environment. If the tinnitus becomes more bothersome, she is instructed to use Aqua plus noise (slot B), and if she does not enjoy the Zen tones, to use the noise only (slot C).

At the second follow-up session one month after the fitting Jeanne indicates that she is very satisfied with the hearing aids. She still perceives her tinnitus in quiet situations, but with the help of Zen she is less bothered by it. She likes to listen to Zen+ when she is at home preparing her classes, and she finds the fractal tones to be very relaxing and conducive to concentration. The Sound Diary shows that Jeanne is using the hearing aids 9 hours per day. The Master program is used most of the time, but Zen+ (slot A) is used quite often and Slot B on some occasions.

The third follow up occurs three months after the initial hearing aid fitting. Jeanne is still very happy with her hearing aids and is using them all day. Jeanne reports

that she still perceives her tinnitus, but that she doesn't pay attention to it. On the rare days when she is bothered by it she uses the program in slot B, but otherwise, she likes to listen to Zen aqua. The TFI score is 16 indicating that her negative tinnitus reaction has been reduced.

At the fourth follow-up six months post fitting, Jeanne states that she doesn't notice her tinnitus any longer. She uses the hearing aids all day. The Sound Diary shows that the Master program is used 90% of the time and that Zen+ is used 10% of the time. Jeanne claims that she still likes to use Zen+ when she is working at home. The TFI score is 6. It is recommended that given her family history, follow-up visits be scheduled on an annual basis or sooner, if needed.

Moderate tinnitus reaction with hearing loss

Paul, 51 years
Paul has been a construction worker for the past 20 years. He wears hearing protection inconsistently at work. He recently got divorced. He has custody of his two children. He enjoys fitness training and spending time with his friends. He loves sports and enjoys watching baseball on TV, but has noticed increasing difficulty hearing the TV and conversing, particularly in noisy situations. He has been aware of tinnitus for many years in quiet situations, but he feels it has recently gotten worse, and he can now hear it even in the presence of some background noise. He sometimes becomes very annoyed with his tinnitus especially at bedtime. Some evenings it even prevents him from falling asleep. As he has started to be annoyed by his tinnitus, he has decided to contact an ENT for advice.

The ENT rules out any treatable or systemic etiologies of Paul's tinnitus. Paul's audiogram reveals a bilateral hearing loss with a moderate notch from 3-6 KHz. Since Paul is complaining a lot about his tinnitus, he is referred to a hearing care professional for tinnitus counseling and amplification.

At the first meeting with the hearing care professional, Paul reveals that tinnitus is the primary issue for the visit. Regarding his hearing loss he believes he is doing well in most situations and does not see the need for hearing aids. The Widex Zen Therapy intake questionnaire indicates that Paul has been exhibiting some angry, aggressive behaviors toward his children that he blames on the tinnitus and poor sleep. The total TFI score is 54 indicating a moderate tinnitus reaction.

The hearing care professional begins by reviewing the questionnaire and subjective scales with Paul. Next he provides instructional counseling about the incidence of tinnitus, the connection between tinnitus and hearing loss and stress and the process of habituation. He also explains the objective of the recommended tinnitus intervention for Paul and that the recommendation will include hearing aids, not necessarily to enhance his hearing, but primarily to provide stimulation to the impaired frequency regions in his cochlea and auditory cortex in the hope that his central nervous system will not try to compensate for the reduced hearing, and also to provide partial masking and a relaxing stimulus to help him when he is not at work and at bedtime. Binaural BTE aids with open fittings are recommended. Paul is not happy about the use of hearing devices, but he understands that since the devices are primarily to help his tinnitus, he is willing to try them.

At the fitting session Paul is fitted with two Widex hearing aids with open fit and remote control. A master program and a Zen+ program is added with Zen aqua in slot A, Zen aqua + noise in slot B and Zen noise in slot C. It is recommended that he uses the programs in Zen+ for passive listening (that is, to not actively focus on the Zen tones), and he is instructed to use slot A most of the time and slot B or slot C for periods where the tinnitus is more bothersome. Paul is also urged to use ear protection consistently when around machinery and to remove the hearing aids when around high levels of noise at work. A basic counseling about the hearing aid use and maintenance is provided, including how to access to Zen+ program and change the volume.

Paul returns one week later and indicates that although he has used the devices several hours each day, especially when he is at home, he is still very aware of his tinnitus "all the time" and feels the need to increase the volume of slots A and B so that he won't hear the tinnitus at all. He also states that his sleep pattern is becoming more erratic and he is becoming ill-tempered. The TFI score has actually worsened to 58. The Sound Diary shows that Paul has used the hearing aids 4 hours per day. Both slot A and slot B of the Zen+ program have been used and the volume has been increased most of the time. He also states that he finds the noise to be extremely annoying and feels the tones are a bit boring. As a result the hearing care professional goes into the Fine tuning window and settings in the Zen+ window and allows Paul to listen to the other Zen tones to see if he finds that any of the other tones reduce the annoyance of his tinnitus while still being relaxing. He indicates that he finds the Aqua style to be more relaxing, but that Lavender seems to make his tinnitus less noticeable. The hearing care professional then modifies slot B by selecting Lavender instead of Aqua, and turns off the noise. The hearing care professional also modifies slot C by removing the noise, turning off the micro-

phone, and adding Aqua as the Zen style. The purpose of this change is to provide a setting with no amplification but with a relaxing background tone.

The hearing care professional again describes the physiologic relationship of emotions (limbic system) to perception and the fact that there is a feedback loop for tinnitus distress between a negative reaction and increased tinnitus and that habituation is not immediate and may require many months. The rationale for the Zen tones is reiterated and Paul is informed that the purpose of the Zen tones is NOT to mask the tinnitus completely, but is instead to help him habituate and relax. It becomes clear that Paul is mostly upset about having to wear hearing aids when, in fact, his hearing loss is not the primary problem. The hearing care professional initiates cognitive behavioral intervention by explaining the rationale behind. Afterwards Paul is asked to complete a worksheet identifying his initial negative thoughts. He is also asked to complete a worksheet describing the behaviors that are being negatively impacted by his tinnitus. Among the issues identified are sleep, anger, and concern for the future. A list of sleep suggestions (including using a fan at night next to his bed) is provided. Given his apparently increasing anger, Paul is also shown relaxation exercises and given a sheet describing them. He was instructed to spend at least 15 minutes per day performing these exercises.

At the second follow up, Paul relates that he has been using the instruments more often. He admits being less bothered by his tinnitus, but there are still episodes – especially when watching sports at home - where he gets very irritated. He is provided with a list of common cognitive distortions and is asked to again complete a worksheet listing his negative thoughts, but this time to also think about which of the cognitive distortions characterize each of the negative thoughts, and a third column identifying an alternative thought. Paul indicates that he prefers to use slot B when tinnitus has increased or it is very bothersome. The Sound Diary shows that the hearing aid has been used on average 5 hours a day and that Zen+ slot A is used about 45% of the time. Slot B is used approximately 25% of the time. He also has begun practicing deep breathing and Progressive Relaxation, and when he does this he uses Slot C (Aqua with microphone off). TFH is now 48. One week later, Paul faxes the worksheet to the hearing care professional who calls him to review and discuss the alternative thoughts.

Three months later Paul returns and states that he is now handling his tinnitus much better and is wearing the devices whenever he is not around noisy machinery. He still perceives his tinnitus, but does not think about it as much and does not get as irritated as before. The use of Zen+ is up to 9 hours per day and Zen+ slot A is used almost all the time, except when relaxing, when he instead uses slot C. The TFI score is now 28.

After six months Paul comes back and is quite satisfied with the instruments. In addition, he notes that he has been using the master program (without the Zen+) more often because he notices that he hears better when watching sports and when conversing with his friends. He requests slightly higher gain in the high frequencies. The Sound Diary shows that the instruments are being used 9 hours a day. The master program is used 30% of the time while Zen+ slot A is used 60% of the time. He continues using slot C during relaxation exercises. He rarely thinks about the tinnitus, and reports that the use of the fan noise, and an over the counter sleep aid prescribed by his physician are helping greatly. He has been spending time talking about his frustration with his children and their relationship has improved. The TFI score is now 22.

Severe tinnitus reaction with asymmetrical hearing loss

Sarah, 48 years

Sarah is a designer and has worked for fifteen years in this field. She is very dedicated to her work and has always enjoyed it. She is not married. She had a serious relationship lasting for three years, but it ended in a very unpleasant manner two months ago and she has been depressed and anxious about her future ever since. Sarah has had a slight tonal tinnitus which was not particularly bothersome for as long as she remembers, but during the last two months the tinnitus in her right ear has increased significantly, and she is now very bothered by it. She used to go to Pilates class and jogged with friends but has stopped doing this, preferring to be home alone. She reports hearing her tinnitus “all the time” and is not able to concentrate at work. She feels very tired and is stressed and depressed because she can’t accomplish her goals. Her tinnitus seems worse when she is at home because it is quiet. Her sleep pattern has started to change, and she needs sleeping pills to be able to fall asleep. She often wakes up in the middle of night, and it is difficult for her to fall asleep again because of the ringing in her ears. The tinnitus is affecting her quality of life substantially, and she feels she cannot do normal activities without thinking about the tinnitus. She is considering quitting her job.

Sarah sought professional help to get immediate relief since her tinnitus is becoming unbearable. Her physician said there is nothing that can be done (which

made her very upset) and she asked for a referral to a hearing care professional. Sarah has a mild to moderate, gradually sloping sensorineural hearing loss above 1000 Hz in the right ear and a very slight hearing loss above 4000 Hz in the left ear. At her first appointment with the hearing care professional, the Widex Zen Therapy Intake Questionnaire was administered along with an audiogram and subjective baseline scaling using the TFI. The initial interview and the Widex Zen Therapy intake questionnaire reveal a severe negative tinnitus reaction. She gets a total TFI score of 76. She indicated on the questionnaire that she is bothered by the tinnitus 100% of the time and that it is mostly in her right ear. The hearing care professional tested her hearing and referred her to an ENT before further intervention due to the asymmetry in the hearing loss and the unilateral tinnitus.

The MRI was negative and the ENT referred back to the hearing care professional. The hearing care professional first reassured Sarah that the ENT examination and MRI suggested there is no serious condition that is causing the tinnitus and that it was likely a consequence of her hearing loss. During tinnitus matching procedures, the hearing care professional discovered that Sarah also has tinnitus in her left ear, but it is not as loud as in the right ear, so normally she only perceives it in the right ear. The hearing care professional was an experienced tinnitus counselor so the Widex counseling videotape was not given to Sarah. Instead, the hearing care professional spent one hour providing instructional counseling about what is known about tinnitus, and then the questionnaire was reviewed in detail. One of the areas discussed was Sarah's response that she is bothered by the tinnitus 100% of the time. The hearing care professional asked Sarah if she could identify ANY times when she was not bothered. Sarah indicated that she is not bothered when she is in the shower or when she goes to an occasional movie. After further probing, she acknowledged that she is bothered about 50% of the time. With this admission, the hearing care professional began Cognitive Behavioral Intervention by explaining the rationale behind CBI, including the ABC model, and Sarah was asked to chart her negative thoughts and emotions. It was explained how negative thinking leads to stress, which leads to limbic system activation, which leads to autonomic nervous system activity, which leads to increased tinnitus perception and difficulties coping. Habituation was explained with specific examples (such as how Sarah was not aware of the humming sound of the computer she uses at work), and Sarah stated that she felt grateful a professional was finally listening to her and encouraged for the first time since the tinnitus increased two months ago. An agreement was reached that she would resume Pilates class and jogging with her friends as it was explained that sitting at home focusing on the tinnitus and how unlucky she was to have it was a maladaptive, counter-productive behavior which impeded the natural course of habituation. The hearing care professional and Sarah also discussed the pros and cons of quitting her job, and they reached the conclusion that such an action was not logical and would not likely produce a positive change.

Once these cognitive behavioral interventions were discussed, the hearing care professional described how Sarah's hearing loss was blocking some of the neural signals to her brain and how the brain might be overcompensating. It was then explained how sound stimulation may help the brain habituate to the tinnitus sound even though Sarah did not necessarily feel the need for amplification for hearing purposes. Next, a 4 KHz narrow-band noise was sent into Sarah's right ear at 10 dB above her threshold (a level just high enough to mask her tinnitus), and she indicated that now she perceived the tinnitus in her left ear. The hearing care professional explained that this was not uncommon and proceeded to recommend binaural Widex open fit RICs. Sarah is asked to come back one week later for the fitting of the hearing aids.

One week later Sarah is fit with the devices. She is given a master program and a Zen+ program with Zen aqua in slot A, Aqua + noise in slot B and Zen noise in slot C for both ears. When verifying the Zen tone and Zen noise volume levels using the play button in Compass, Sarah mentions that the levels are too low and that she is still very much aware of her tinnitus. The volume level of the Zen tones and the Zen noise in slots A, B and C is therefore increased, and she is instructed on how to use the volume control on the remote for adjusting the level of the Zen tones and Zen noise. Sarah is instructed to use Zen+ slot B all day, or slot C if she prefers the noise only. It is recommended Sarah listen to CDs with relaxing music or nature sounds at bedtime. If this doesn't help, she is advised to try sleeping with her hearing aids using slot A or slot C depending on which she likes better. Instructional counseling is still the main focus in this session. Sarah is asked to come back after one week or call in a couple of days if she is having difficulty managing the hearing aids.

Sarah comes to the third session one week later. She has used the hearing aids several hours a day. She has used Zen+ slot B almost all the time. She didn't like Zen noise alone. Sometimes the tinnitus is very bothersome and she feels a need for increasing the volume. She was not able to use Zen+ for sleep, because she also heard other sounds that prevented her from falling asleep. Sarah is still very apprehensive if the treatment is going to help since she hasn't experienced any relief

yet. The Sound Diary shows that Sarah has worn the hearing aids more than 8 hours per day. The Zen+ slot B program has been used and the volume has been increased. The hearing care professional fine-tunes Zen+ by removing the noise from slot C and instead substitutes a sleep program with Zen Lavender (because the fast tempo produces the most masking effect) without microphone and with limited play time for sleep or relaxation purposes. The Lavender was selected after Sarah was given the opportunity to listen to all five Zen styles. The hearing care professional recommends Sarah continue to use Zen+ slot B since it will give her a sense of relief and control and hopefully reduce the negative reactions caused by the tinnitus. Sarah is advised to turn up the volume of the Zen styles and noise only when she finds her tinnitus to be unbearable. At other times she should avoid adjusting the volume and just let the tones and noise play at a constant level giving passive stimulation. The use of program C is recommended for relaxation and prior to bedtime. The hearing care professional continues applying cognitive behavioral intervention discussing cognitive distortions (all or nothing thinking, magnification, etc.) and assigning her "homework" to help challenge the cognitive distortions and negative thoughts. In addition, the hearing care professional demonstrates and provides her with relaxation exercises to help reduce the stress. She is asked to do the relaxation exercises one or two times a day according to her needs.

Sarah comes to the second follow-up visit one month after the initial hearing aid fitting. She has continued to wear the hearing aids several hours a day. She thinks that Zen+ slot C is very useful for relaxation and useful to her prior to bedtime. The Sound Diary shows that the hearing aid is used 13 hours a day with Zen+ slot B activated most of the time. Slot C is also used (20% of the time). She is less bothered by the tinnitus, but there are still periods where she gets very annoyed and stressed by her tinnitus. She enjoys the relaxation exercises and thinks they help a lot as she is not as tired as she used to be. The "homework" assignments have helped her recognize the cognitive distortions she has been making regarding her tinnitus and how these negative thoughts are impacting both her social life and her professional life. She promises to continue reaching out to her friends. Sarah admits however, that she feels "weak" and guilty that she allowed herself to get into the negative position that has possibly made her tinnitus worse, but the hearing care professional assures her that the reaction in the limbic system can be conscious or subconscious, and that either way, the reaction can be modified.

Two months later Sarah comes for the next follow-up visit. She feels much better. Her sleep issues have improved and she is able to perform several activities without noticing the tinnitus. She still, however, has some terrible days where she feels tired and hopeless because of her tinnitus. She wears the hearing aids several hours a day mainly in slot B, but she has also started to use slot A more. Her tinnitus is not as bothersome as in the beginning of the treatment, and she likes to listen to the Zen tones only. She still does the relaxation exercises but does not feel they help as much as before. The Sound Diary confirms Sarah's comments. She uses Zen+ more than 13 hours per day. Zen+ slot B is still the preferred program, but slots A and C are used as well. She does not use the volume control any longer in slot B. The TFI score is now 45. The hearing care professional decides that a referral to a trained psychologist may be in order, This is discussed with Sarah and she agrees with the recommendation.

Four months later Sarah comes for the next follow-up visit. She is continuing to improve and her weekly sessions with the psychologist have been quite useful. The TFI score is now 26. After six months Sarah comes back and is very stable. She has learned to live with her tinnitus and she is not bothered by it as she used to be. She sleeps better and she has returned to doing her normal leisure activities. She feels fresher than before. She still uses the hearing aids, but less than before. The Sound Diary shows that the hearing aid use is now 8 hours per day mainly in slot A. The TFI score is now 14.

After one year Sarah comes for the final follow-up. She hardly notices her tinnitus and only wears the hearing aids when she finds it necessary, as when she is stressed or bothered by her tinnitus. Otherwise she does not feel a need for the hearing aids any longer. The total TFI score is 12. Sarah is instructed to set up a new appointment when she finds it necessary.

Catastrophic tinnitus reaction with hearing loss

Peter, 70 years

Peter recently retired after working 35 years as a bus driver. He lives with his wife and has three children and five grandchildren. He used to enjoy tending to his garden and playing with his grandchildren, but lately he has become depressed and has noticed a considerable increase in his long-standing tinnitus. He is having great difficulty hearing, he hears the tinnitus all the time and it is seriously affecting his quality of life. Several days a week Peter is not able to fall asleep and when he finally falls asleep he wakes up shortly after because of the tinnitus. He is afraid that he has a serious disease. He feels hopeless and is arguing continuously with his wife who thinks he is a hypochondriac.

Basically, he does not want to do anything. He does not answer the phone and stays at home all day. He has admitted to his wife that he has considered suicide as a means to end it all.

The one person Peter gets along with is his daughter. Even though Peter is very reluctant, his daughter convinces him to seek professional help and takes him to his physician. Her hope is that Peter will find immediate relief since his tinnitus is unbearable. The physician indicates that Peter is basically healthy and orders an audiogram. The hearing evaluation reveals a moderate degree hearing loss. The physician also informs Peter and his daughter that there is no cure for tinnitus and refers him to a hearing care professional for tinnitus therapy.

The hearing care professional performs an initial interview and asks Peter and his daughter to fill out the Widex Zen Therapy intake questionnaire and TFI. Both indicate an extreme negative tinnitus reaction and the TFI total score is 82. Instructional tinnitus counseling is provided. The hearing care professional addresses the relation between tinnitus, hearing loss and stress, and explains the possible tinnitus causes. He also explains the objective of the intervention and how the fact that there is no cure is not the same as there being no help. He explains the habituation process in relation to tinnitus, and gives examples on how the brain is capable of suppressing irrelevant stimuli. Finally the hearing care professional explains how sound stimulation may help the habituation process and therefore should be incorporated into the treatment plan for Peter. Peter listens quietly to the hearing care professional and then angrily indicates that the hearing care professional is no better than the physician and that both professionals are plotting against him along with his wife. He abruptly leaves the session. The hearing care professional asks the daughter if he can phone her to discuss the next steps. She agrees and expresses her appreciation. That evening, the hearing care professional calls Peter's daughter who expresses grave concern that her father may harm himself. The hearing care professional suggests a referral to a psychiatrist he has worked with in the past who is involved with Suicide Prevention. Peter's daughter discusses this with both Peter and his wife, and they all agree to meet with the psychiatrist. The psychiatrist prescribes an antidepressant for Peter and convinces him to return to the hearing care professional.

One month later, Peter makes an appointment with the hearing care professional, who insists that his wife attend their sessions. At the appointment, the hearing care professional recaps the instructional counseling, again emphasizing the relationship between hearing loss and tinnitus and stress and tinnitus. The hearing care professional performs tinnitus matching procedures and then plays a simulated tinnitus signal to Peter's wife, who for the first time, begins to understand what Peter has been experiencing. The hearing care professional again recommends the use of hearing aids. Peter claims he is willing to try but is worried that they might make the tinnitus worse and that he has had friends who have tried hearing aids unsuccessfully. A trial with binaural Widex hearing aids is recommended. Peter is asked to come back after one week.

A week later Peter and his daughter come back and the hearing aids are fit. Peter's initial reaction is that the amplified sound is too loud and that it is making his tinnitus louder than before. Overall gain is reduced to less than desired levels, and fine-tuning is completed to provide audibility without discomfort to loud sounds. After this adjustment, Peter says he will try them at home. In addition to the master program, a Zen+ program is added with Zen Aqua in slot A, Zen Aqua + noise in slot B and Zen noise in slot C. He is instructed in how to access the various programs and when to use them.

Peter and his wife and daughter come to the next session one week later. Peter claims he has been wearing the hearing aids but he doesn't like them. His wife and daughter indicate that he has not been wearing the aids. A check of the Sound Diary confirms the wife and daughter's suspicion and Peter is gently confronted with the fact that the computer has indicated he has not been wearing the devices. Peter reports that he is worried they will make things worse. The hearing care professional acknowledges that a very small minority of tinnitus sufferers can experience a form of "reactive" tinnitus but that he is taking every precaution to ensure this doesn't happen. He asks Peter to listen to all five of the Zen styles and noise. The hearing care professional activates tones and noise from the Zen library for thirty seconds each and then asks Peter to judge which of the programs provides both relaxation and interference with his tinnitus perception (without making the tinnitus louder). Peter indicates that he is less aware of tinnitus with Zen noise, however the loudness of his tinnitus is still greater than the Zen noise. He affirms also that Zen aqua + noise is more relaxing to listen to. The hearing care professional reminds Peter and his family that habituation does not occur as well when the tinnitus is completely masked, but he still fine-tunes the programs B and C by increasing the noise volume, until Peter thinks his tinnitus is slightly less noticeable. Peter is instructed to use slot B for four hours per day for the next three days, and then to increase his wearing time by two hours a day until he reaches full time usage. He is also instructed to try slot C for periods where the tin-

nitus is very bothersome. The hearing care professional also asks Peter's permission to communicate with his psychiatrist in order to coordinate any cognitive behavioral intervention with the psychiatrist's treatment plan. The psychiatrist agrees to utilize his own intervention techniques which include cognitive behavioral therapy and guided imagery, and asks the hearing care professional to proceed with teaching Peter relaxation techniques, including deep breathing and progressive muscle relaxation. Before leaving, Peter thanks the hearing care professional and states that he trusts him because the hearing care professional is being honest with him and not trying to "bully" him into doing something he does not want to do. The hearing care professional thanks him for the confidence and assures him that this is a battle that can be won and that he will be there to provide support.

When Peter and his daughter come back the week after, he is feeling a little better. He has been using the hearing aids consistently and feels that they are definitely helping him to communicate at home and also giving him some relief from his tinnitus. He also tried the breathing technique, and feels it is helping him to notice when he becomes tense and then to relax. The Sound Diary shows that Peter has worn the hearing aids 5 hours per day in Zen+ slot B. Slot C has been used 15% of the time, and the volume has been increased. The hearing care professional slightly increases the gain. The slot B is recommended for use during the relaxation exercises. The hearing care professional reinforces the importance of using Zen+ at all times since it will give Peter a sense of relief and control, and hopefully reduce the negative reactions caused by the tinnitus. Peter is advised to use the volume control in periods where he thinks his tinnitus gets worse.

Peter comes by himself three weeks later because his wife has another meeting to attend. He has continued to work with the psychiatrist and feels he is definitely improving. He now uses the hearing aids during all his waking hours. To gauge Peter's understanding of the process, he is asked to list some of the barriers to habituation which may have hindered him. He correctly cites: stress, depression, fatigue, lack of insight into the problem, and irrational thoughts, fears, and attitudes which led him to engage in maladaptive behaviors and thoughts. The Sound Diary shows that Peter has used the hearing aids 8 hours per day in Zen+ at slot B, but the volume control has not been accessed as last week.

The next follow-up visit planned two months later is cancelled by Peter. He is doing well with the hearing aids, has continued to work with the psychiatrist and feels he is definitely improving.

Peter comes for the follow-up visit four months later. He feels much better; he sleeps better and he has started to attend weekly card games with his friends, he and his wife are getting along well, and while he still notices tinnitus on occasion, he does not get upset about it and simply acknowledges it and then engages in other activities. He also reports that he doesn't know how he ever got along without the hearing aids! He has been dismissed by the psychiatrist who has pronounced him mentally stable. His TFI score is now 18.

PART **3**

APPENDICES

APPENDICES

Appendix A: Widex Zen Therapy Intake Questionnaire

Appendix B: Tinnitus Functional Index (TFI)

Appendix C: Tinnitus Handicap Inventory (THI)

Appendix D: Tinnitus Reaction Questionnaire (TRQ)

Appendix E: Tinnitus Handicap Questionnaire (THQ)

Appendix A: Widex Zen Therapy Intake Questionnaire

Name: _____ **Age**: _____ **Date**: _____

Work

1. Are you employed?_____ # of hours/week _____
2. What is your occupation? _____
3. Are you satisfied? _____
4. If not employed, is your unemployment due to tinnitus? _____

Tinnitus characterization

5. When did you first experience tinnitus? _____
6. How long have you had tinnitus in its present form? _____ years_____ months
7. Briefly describe what you were doing when the tinnitus first became apparent to you.

   _____

   _____

8. Were you experiencing any kind of emotional trauma at the time when you first noticed your tinnitus?

   _____

   _____

9. What do you think is the cause of your tinnitus?

   _____

   _____

10. Where is your tinnitus primarily located?

    ☐ left ear ☐ right ear ☐ both ears equally ☐ head

11. Using the scale below, indicate the **loudness** of:

    A) Your tinnitus right now_____ B) Your average tinnitus _____

    C) Your tinnitus at its worst _____ D) Your tinnitus at its least_____

0	1	2	3	4	5	6	7	8	9	10
none			mild		moderate			severe		excruciating

12. Using the scale below, indicate the **pitch** of your tinnitus. (It might help to imagine the scale as if it were a piano keyboard.)

0 1 2 3 4 5 6 7 8 9 10
low pitch mid pitch high pitch

13. Check all items below which describe the sound of your tinnitus:

- ☐ hissing
- ☐ ringing
- ☐ cricket-like
- ☐ whistle
- ☐ steam whistle
- ☐ pounding
- ☐ pulsating
- ☐ bells
- ☐ clanging
- ☐ buzzing
- ☐ sizzling
- ☐ clicking
- ☐ ocean roar
- ☐ high tension wire
- ☐ other

Hearing loss

14. Do you have a hearing loss? ☐ yes ☐ no ☐ not sure

15. Which is more of a problem for you, the hearing difficulty or your tinnitus?

☐ hearing difficulty ☐ tinnitus ☐ not sure

16. Have you been exposed to loud noise? ☐ yes ☐ no

If so, when? ☐ military service ☐ work ☐ recreation

Other: _____

17. Do you wear ear protection in the presence of loud sounds? ☐ yes ☐ no

18. Have you ever worn a hearing aid? ☐ yes ☐ no

If yes, do you currently wear it (them)? ☐ yes ☐ no

If you no longer wear hearing aids, why not? _____

19. If you are a hearing aid user, how does the aid affect your tinnitus?

☐ makes tinnitus softer ☐ makes tinnitus louder ☐ no effect

20. Are you adversely affected by loud sounds? ☐ yes ☐ no

Please explain: _____

Tinnitus reaction

21. Overall, to what extent are you **bothered or annoyed by** your tinnitus?

0 1 2 3 4 5 6 7 8 9 10
not bothered mild moderate severe extreme

22. What percentage of the time are you **aware** of your tinnitus?_____

23. What percentage of the time are you **bothered** by your tinnitus?_____

24. How has the percentage of the time you are bothered by your tinnitus changed since you first noticed it? _____

25. The loudness of your tinnitus is (check one):

- ☐ fairly constant from day to day
- ☐ fluctuates widely, being very loud some days and very mild other days
- ☐ usually constant, but occasionally decreases markedly
- ☐ usually constant, but occasionally increases markedly

26. Does your tinnitus appear worse:

- ☐ when tired
- ☐ at bedtime
- ☐ upon awakening
- ☐ when tense or nervous
- ☐ after use of alcohol
- ☐ when relaxed

27. Is there any time during the day when your tinnitus is most troublesome to you?

- ☐ at work
- ☐ in evening
- ☐ at social activities
- ☐ in morning
- ☐ when trying to concentrate
- ☐ around noise

Other: _____

28. Do you consider yourself to be a tense person? _____

29. Do you feel that emotional or physical stress worsens the tinnitus? _____

30. What do you feel adds to your stress (job, time management, home, etc.)?_____

_____

_____

31. Do you feel depressed or ever have suicidal thoughts?_____

32. What do you do to relax: meditate, listen to music, etc.?

_____

33. How does your tinnitus interfere with your activities?

Work/Chores _____

Family _____

Religious activities _____

Social/Recreation _____

Exercise _____

Sleep _____

34. Does the tinnitus prevent you from falling asleep? _____

35. Does the tinnitus awaken you from sleep? _____

36. Are you able to fall back asleep, once awakened? _____

Other _____

37. What do you do when you have trouble sleeping?

☐ Medications ☐ Mental exercises ☐ Watching TV ☐ Other

38. How would your life be different if you didn't have tinnitus?

_____

_____

39. Have you discussed your tinnitus with friends or family members? _____

What was their reaction? _____

40. Are there other members of your family or friends who suffer from tinnitus? _____

41. Do you live alone? _____

Treatment history:

42. Please list all evaluations and/or treatments (including psychiatric or psychologic) you have had for your tinnitus. Please include the names of the specialists who have performed evaluations or treatments, and the approximate dates on which they were performed, using the reverse side, if necessary.

Specialist	What was done?	How long ago?	Result
1. Physician			
2. ENT doctor			
3. Hearing care professional			

What type of specialist	What was done?	How long ago?	Result
1.			
2.			
3.			
4.			
5.			

43. Please list any surgeries you have had (potentially related to your current symptom of tinnitus)

_____

_____

_____

44. Please list the medications you are currently taking for tinnitus?

Medication	For what purpose?	How often?	Does it help?
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

45. What medications have you tried in the past for tinnitus relief?

Medication	How often?	Does it help?	Stopped (Why?)
		☐ Yes ☐ No	
		☐ Yes ☐ No	
		☐ Yes ☐ No	
		☐ Yes ☐ No	

46. Please list all other medications you currently take:

Medication	How often?	Purpose?

47. Using the number codes below, please indicate the results of those treatments you have tried for your tinnitus. If you have not tried a given treatment, please place an "NA" in the blank for that treatment.

1 = Major relief
2 = Some relief
3 = No relief
4 = Some relief with bad side effects
5 = Tinnitus worse
NA = Not applicable, treatment not tried

_____ Surgery	_____ Acupuncture
_____ Drug therapy	_____ Massage
_____ Hearing aids	_____ Homeopathy
_____ Masking therapy	_____ Biofeedback
_____ Physical therapy	_____ Chiropractic
_____ Antidepressants	_____ Relaxation training or hypnosis
_____ Exercise program	_____ Psychotherapy or other counseling
_____ Dental	_____ Dietary Management or nutrition counseling

Other:_____

48. Do you have any ear, nose or throat diseases?

_____

_____

_____

_____

49. Do you have any other diseases that affect you in your daily life?

_____

_____

_____

_____

50. Any other issues you would like us to know about?

_____

_____

_____

Appendix B: Tinnitus Functional Index (TFI)

Today´s Date: _____ **Your Name** _____
Month / Day / Year Please Print

Please read each question below carefully. To answer a question, select ONE of the numbers that are listed for that question, and draw a CIRCLE around it like this: (10)% or (1.)

I. Over the PAST WEEK…

1. What percentage of your time awake were you consciously **aware of** your tinnitus?

   Never aware ▶ 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100% ◀ Always aware

2. How **strong** or **loud** was your tinnitus?

   Not at all strong or loud ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Extremely strong or loud

3. What percentage of your time awake were you **annoyed** by your tinnitus?

   None of the time ▶ 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100% ◀ All of the time

SC. Over the PAST WEEK…

4. Did you feel **in control** in regard to your tinnitus?

   Very much in control ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Never in control

5. How easy was it for you to **cope** with your tinnitus?

   Very easy to cope ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Impossible to cope

6. How easy was it for you to **ignore** your tinnitus?

   Very easy to ignore ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Impossible to ignore

C. Over the PAST WEEK…

7. Your ability to **concentrate**?

   Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

8. Your ability to **think clearly**?

   Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

9. Your ability to **focus attention** on other things besides your tinnitus?

   Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

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SL. Over the PAST WEEK...

10. How often did your tinnitus make it difficult to **fall asleep** or stay **asleep**?

Never had difficulty ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Always had difficulty

11. How often did your tinnitus cause you difficulty in getting **as much sleep** as you needed?

Never had difficulty ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Always had difficulty

12. How much of the time did your tinnitus keep you from **sleeping** as **deeply** or as **peacefully** as you would have liked?

None of the time ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ All of the time

A. Over the PAST WEEK, how much has your tinnitus interfered with...

13. Your ability to **hear clearly**?

Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

14. Your ability to **understand people** who are talking?

Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

15. Your ability to **follow conversations** in a group or at meetings?

Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

R. Over the PAST WEEK, how much has your tinnitus interfered with...

16. Your **quiet resting activities**?

Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

17. Your ability to **relax**?

Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

18. Your ability to enjoy "**peace and quiet**"?

Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

Q. Over the PAST WEEK, how much has your tinnitus interfered with...

19. Your enjoyment of **social activities**?

Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

20. Your **enjoyment of life**?

Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

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21. Your **relationships** with family, friends and other people?

    Did not interfere ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Completely interfered

22. How often did your tinnitus cause you to have difficulty performing your **work or other tasks**, such as home maintenance, school work, or caring for children or others?

    Never had difficulty ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Always had difficulty

E. Over the PAST WEEK...

23. How **anxious** or **worried** has your tinnitus made you feel?

    Not at all anxious or worried ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Extremely anxious or worried

24. How **bothered** or **upset** have you been because of your tinnitus?

    Not at all bothered or upset ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Extremely bothered or upset

25. How **depressed** were you because of your tinnitus?

    Not at all depressed ▶ 0 1 2 3 4 5 6 7 8 9 10 ◀ Extremely depressed

References

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Instructions for scoring the tinnitus functional index (TFI)

1. Preparation for scoring:

A. Two items to be transformed: Items #1 and #3 require a simple transformation from a percentage scale to a 0-10 scale, achieved by dividing the values circled by the respondent by 10. The examiner should write the transformed value in the margin beside the relevant item, preferably using ink of a different color than that used by the respondent.

B. Ambiguous items: Because respondents differ in regard to how clearly they circle or mark their answers on the 0-10 scale for each item, the examiner should review every item to resolve any ambiguities. It is helpful if examiners note their decision about each answer in the margin beside the given item, using the differently-colored ink. Some commonly-occurring ambiguities and how to handle them are as follows:

(1) More than one value marked on the 0-10 scale for a given item—Typically done by respondents whose tinnitus undergoes large variations over time. The clinic or the examiner should settle on a consistent procedure for all such responses, such as (a) averaging the multiple values indicated for a given item, or (b) marking the item "cannot code", thus removing that item from consideration in the overall TFI score. (The latter choice reduces the information available for calculating the respondent's overall score, and may be desirable only in extremely variable cases where the respondent's reliability is questionable.)

(2) Respondent marks a value between the 0-10 values on the item scale— Again, the clinic or the examiner should settle on a consistent procedure for handling all such ambiguous responses in the same way, such as (a) noting a value of 3.5 in the margin, for a respondent who marked the scale between 3 and 4, or (b) collapsing the intermediate value either to the right (to 4) or to the left (to 3).

(3) Respondent does not make any response to a given item—The clinic or examiner should decide beforehand how they will indicate missing values, and that notation (e.g. "NA" for "No Answer") should be entered in the margin. If the data will be entered into a computer database, a standard missing value such as "99" can be entered in the margin beside the relevant item. Of course, care must be taken to exclude "99" values if the examiner performs a manual calculation of the overall TFI score.

C. Unambiguous items: To facilitate rapid scanning and summing of all valid answers to obtain the respondent's overall TFI score, all of the unambiguous values indicated by the respondent should also be noted in the margin, each such value beside its corresponding item. The examiner can then quickly generate a valid score for the overall TFI.

2. Calculation of overall TFI score:

1) Sum all valid answers from both TFI pages (maximum possible score = 250 if the respondent were to rate all 25 TFI items at the maximum value of 10).

(2) Divide by the number of questions for which that respondent provided valid answers (yields the respondent's mean item score for all items having valid answers).

(3) Multiply by 10 (provides that respondent's overall TFI score within 0-100 range).

CAUTION—Overall TFI score is **not valid** if respondent **omits 7 or more** items. To be valid as a measure of tinnitus severity, the respondent must answer **at least 19 items** (76% of items).

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3. Calculation of subscale scores

The 8 subscales address 8 important domains of negative tinnitus impact as indicated below. Each subscale has a brief title (in capital letters) and a 1- or 2-letter abbreviation (e.g. I for Intrusive , SC for Sense of Control):

SUBSCALE NAME (and conceptual content)	ITEMS IN SUBSCALE
I: INTRUSIVE (unpleasantness, intrusiveness, persistence)	#1, #2, #3
SC: SENSE OF CONTROL (reduced sense of control)	#4, #5, #6
C: COGNITIVE (cognitive interference)	#7, #8, #9
SL: SLEEP (sleep disturbance)	#10, #11, #12
A: AUDITORY (auditory difficulties attributed to tinnitus)	#13, #14, #15
R: RELAXATION (interference with relaxation)	#16, #17, #18
Q: QUALITY OF LIFE (QOL) (quality of life reduced)	#19, #20, #21, #22
E: EMOTIONAL (emotional distress)	#23, #24, #25

Each of the 8 subscales consists of 3 items except for the Quality of life subscale, which consists of 4 items (SEE ITEMS LIST ABOVE). For valid subscale scores, no more than 1 item should be omitted. Computation of subscale scores is as follows:

1) Sum all of that respondent's valid answers for a given subscale.

2) Divide by the number of valid answers that were provided by that respondent for that subscale.

3) Multiply by 10. For the respondent in question, this procedure generates a subscale score in the range 0- 100 for each valid subscale.

CAUTION—Do not attempt to compute a respondent's overall TFI score by combining that respondent's valid subscale scores, as the valid subscales may encompass a total number of items that is different from the number of items accepted as valid for the overall TFI score.

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Appendix C: Tinnitus Handicap Inventory (THI)

The purpose of this questionnaire is to identify the problems your tinnitus may be causing you. Check 'Yes', 'Sometimes', or 'No' for each question. Please answer all questions.

1. Because of your tinnitus, is it difficult for you to concentrate?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
2. Does the loudness of your tinnitus make it difficult for you to hear people?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
3. Does your tinnitus make you angry?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
4. Does your tinnitus make you confused?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
5. Because of your tinnitus, are you desperate?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
6. Do you complain a great deal about your tinnitus?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
7. Because of your tinnitus, do you have trouble falling asleep at night?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
8. Do you feel as though you cannot escape from your tinnitus?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
9. Does your tinnitus interfere with your ability to enjoy social activities (such as going out to dinner or to the cinema)?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
10. Because of your tinnitus, do you feel frustrated?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
11. Because of your tinnitus, do you feel that you have a terrible disease?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
12. Does your tinnitus make it difficult to enjoy life?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
13. Does your tinnitus interfere with your job or household responsibilities?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
14. Because of your tinnitus, do you find that you are often irritable	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
15. Because of your tinnitus, is it difficult for you to read?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
16. Does your tinnitus make you upset?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)

17. Do you feel that your tinnitus has placed stress on your relationships with members of your family and/or friends?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
18. Do you find it difficult to focus your attention away from your tinnitus and on to other things?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
19. Do you feel that you have no control over your tinnitus?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
20. Because of your tinnitus, do you often feel tired?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
21. Because of your tinnitus, do you feel depressed?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
22. Does your tinnitus make you feel anxious?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
23. Do you feel you can no longer cope with your tinnitus?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
24. Does your tinnitus get worse when you are under stress?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)
25. Does your tinnitus make you feel insecure?	☐ Yes (4)	☐ Sometimes (2)	☐ No (0)

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CFM07/0311

Appendix D: Tinnitus Reaction Questionnaire (TRQ)

Date: _____ **Your Name** _____

Instructions
This questionnaire is designed to find out what sort of effects tinnitus has had on your lifestyle, general well-being, etc. Some of the effects below may apply to you, some may not.

Please answer all questions by circling the number that best reflects how your tinnitus has affected you **over the past week.**

0 = Not at all
1 = A little of the time
2 = Some of the time
3 = A good deal of the time
4 = Almost all of the time

1. My tinnitus has made me unhappy.	0	1	2	3	4
2. My tinnitus has made me feel tense.	0	1	2	3	4
3. My tinnitus has made me feel irritable.	0	1	2	3	4
4. My tinnitus has made me feel angry.	0	1	2	3	4
5. My tinnitus has led me to cry.	0	1	2	3	4
6. My tinnitus has led me to avoid quiet situations.	0	1	2	3	4
7. My tinnitus has made me feel less interested in going out.	0	1	2	3	4
8. My tinnitus has made me feel depressed.	0	1	2	3	4
9. My tinnitus has made me feel annoyed.	0	1	2	3	4
10. My tinnitus has made me feel confused.	0	1	2	3	4
11. My tinnitus has “driven me crazy.”	0	1	2	3	4
12. My tinnitus has interfered with my enjoyment of life.	0	1	2	3	4
13. My tinnitus has made it hard for me to concentrate.	0	1	2	3	4
14. My tinnitus has made it hard for me to relax.	0	1	2	3	4
15. My tinnitus has made me feel distressed.	0	1	2	3	4
16. My tinnitus has made me feel helpless.	0	1	2	3	4
17. My tinnitus has made me feel frustrated with things.	0	1	2	3	4
18. My tinnitus has interfered with my ability to work.	0	1	2	3	4

19. My tinnitus has led me to despair.	0	1	2	3	4
20. My tinnitus has led me to avoid noisy situations.	0	1	2	3	4
21. My tinnitus has led me to avoid social situations.	0	1	2	3	4
22. My tinnitus has made me feel hopeless about the future.	0	1	2	3	4
23. My tinnitus has interfered with my sleep.	0	1	2	3	4
24. My tinnitus has led me to think about suicide.	0	1	2	3	4
25. My tinnitus has made me feel panicky.	0	1	2	3	4
26. My tinnitus has made me feel tormented.	0	1	2	3	4

Total =

References

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

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Appendix E: Tinnitus Handicap Questionnaire (THQ)

Instructions

This questionnaire has 27 questions. Please indicate **0** that you strongly disagree (up to) **100** that you strongly agree. Please do not skip any questions.

1.	I have support from my friends regarding my tinnitus.	
2.	Tinnitus creates family problems.	
3	My tinnitus has gotten worse over the years.	
4.	I do not enjoy life because of tinnitus.	
5	The general public does not know about the devastating nature of tinnitus.	
6	I am unable to follow conversation during meetings because of tinnitus.	
7	Tinnitus affects the quality of my relationships.	
8	I think I have a healthy outlook on tinnitus.	
9	I cannot concentrate because of tinnitus.	
10	Tinnitus causes me to avoid noisy situations.	
11	Tinnitus contributes to a feeling of general ill health.	
12	Tinnitus interferes with my ability to tell where sounds are coming from.	
13	Tinnitus makes me feel annoyed.	
14	I am unable to relax because of tinnitus.	
15	Tinnitus makes me feel insecure.	
16	Tinnitus makes me feel anxious.	
17	I feel frustrated frequently because of tinnitus.	
18	Tinnitus makes me feel tired.	
19	Tinnitus causes me to feel depressed.	
20	Tinnitus interferes with my speech understanding when listening to the television.	
21	Tinnitus has caused a reduction in my speech understanding ability.	
22	Tinnitus interferes with my speech understanding when talking with someone in a noisy room.	
23	I find it difficult to explain what tinnitus is to others.	
24	I complain more because of tinnitus.	

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25	I have trouble falling asleep at night because of tinnitus.	
26	I feel uneasy in social situations because of tinnitus.	
27	Tinnitus causes stress.	

Scoring:

Factor 1 - Social, Emotional, and Behavioral Tinnitus Effects:

(add responses to 4, 7, 9, 11, 13, 14, 15, 16, 17, 18, 19, 23, 24, 25, and 27) = /15 = %

Factor 2 - Tinnitus and Hearing:

(add responses to 2, 6, 10, 12, 20, 21, 22, and 26) = / 8 = %

Factor 3 - Outlook on tinnitus:

(add responses to 3, and 5, plus [100-response to 8] plus [100-response to 1] = / 4 = %

TOTAL [(Factor 1 x 15/27) + (Factor 2 x 8/27) + (Factor 3 x 4/27)] = %

References
Kuk FK, Tyler RS, Russell D and Jordan H (1990). The psychometric properties of a tinnitus handicap questionnaire. Ear Hear, 11(6): 434-442.

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