Signia’s tinnitus solutions help you better serve your patients and your practice.

Our new “Treating Tinnitus with Signia” program is continuously expanding. We are now offering several new resources to support your patients and your practice. See page 21 for patient forms.
Sound therapy and tinnitus

Tinnitus is the perception of a sound in the ears or in the head with no corresponding external stimuli [1]. There are more than 200 potential causes for tinnitus. They can originate from within or outside of the auditory system. Metabolic, pharmacological, dental, somatic and psychological disorders are all possible culprits for tinnitus. Therefore, it is important to note that every patient is different, and that a single treatment will never be able to satisfy the full spectrum of tinnitus patients. Furthermore, patients with other symptoms in addition to tinnitus need to be treated differently.

The use of external sound(s) can provide relief from tinnitus by inducing neurophysiologic functional changes in the different auditory pathways. The aim of sound therapy is to decrease prominence of the tinnitus and facilitate tinnitus habituation while transforming the individual’s reaction to tinnitus through counseling. Sound therapy features are available in Signia hearing instruments and can support a wide variety of acknowledged tinnitus treatment programs.

There are two types of tinnitus:

1. **Objective** - meaning the tinnitus is audible to someone else besides the patient. This type of tinnitus generally originates from middle ear or vascular system.

2. **Subjective** - meaning the tinnitus is audible just to the patient. It is often considered as the perceptual consequence of modified neural activity, generated by the central auditory pathway, after peripheral damage. High frequency hearing loss is the highest predictive risk factor for tinnitus.

Subjective tinnitus is a common problem affecting approximately 1 in 5 individuals, although the epidemiologic studies show variable rates. It is considered that 10-15% of the population has chronic and persistent tinnitus; and around 20% of those reporting tinnitus find the condition disruptive enough to seek specialized treatment.

There is strong evidence to suggest that acoustic therapy can help mitigate the effects of subjective tinnitus [5]. Acoustic therapy can occur in many forms such as: fitting the patient with appropriate amplification, modifying advanced signal processing features for the purpose of tinnitus treatment, or following a formal tinnitus protocol such as Tinnitus Retraining Therapy (TRT). Signia offers solutions that can be adapted for any therapy protocol to fit the needs of the Hearing Care Professional (HCP) and the patient.

**Use of sound therapy for tinnitus**

Sound therapy for tinnitus has been defined as any use of sound intended to alter the tinnitus perception and reactions for clinical benefit. Besides hearing instrument use for tinnitus relief, numerous methods of sound therapy have been used since tinnitus masking was introduced in the 1970s [7]. Two general types of sound therapy approaches have been investigated for tinnitus management:

1. **Total masking** - using an alternative stimulus to cover up (mask) the perceived tinnitus.

2. **Partial masking** - the addition of an alternative stimulus to reduce the focus of the patient’s subjective tinnitus on both a conscious (psychological level) and unconscious level (central auditory perception).

Both employ the use of broadband noise sound generators, hearing instruments, or combination devices.

The clinical application of sound therapies has generally focused on managing reactions to tinnitus and suppressing perception of tinnitus. Sound therapy is thought to provide relief from tinnitus and reduce the emotional consequences of tinnitus [7]. Some individuals experience residual inhibition following total or partial masking (i.e., tinnitus suppression or temporary disappearance of the tinnitus sensation after exposure to an external sound). Additionally, sound therapy may promote habituation to the tinnitus by reducing the contrast between the tinnitus and environmental sound.

Habituation “is the reduction or elimination of Central Nervous System (CNS) activity in response to repetitive stimuli” (Encyclopedia of Neuroscience, 1987). It is a natural process of the CNS and crucial to brain function.
enabling humans to perform many tasks simultaneously. Habituation is the basis for Dr. Pawel Jastreboff’s Neurophysiologic model of tinnitus (Fig. 1), the predecessor of TRT. In this model, the starting point is the generation of tinnitus by the cochlea or the 8th cranial nerve. The tinnitus is then detected on a subcortical level and, finally, perceived for interpretation by the auditory cortex. At this point, if the tinnitus results in an emotional reaction from the patient, an involvement from the limbic system can occur. The limbic system controls motivation, mood, and emotion. Therefore, a limbic system reaction to tinnitus can cause insomnia, anxiety, depression, and fear. Further complication arises if the emotional reaction is not quelled as the patient may develop physical symptoms related to the patient’s autonomic nervous system.

Whether or not the patient has the ability to habituate to their tinnitus spontaneously is thought to correlate with the impact that tinnitus has on a patient’s daily life. It has been reported that of those reporting the symptom of tinnitus: 80% report no impact on their lives, 15% feel their tinnitus impacts them, and 5% are incapacitated by their tinnitus (Fig. 2).

The 80% with no impact are thought to be the patients that habituate with no intervention. The 15% with impact correlate to those tinnitus sufferers that have developed an emotional response to their tinnitus and the 5% correlate to individuals experiencing a physical response from the Autonomic Nervous System. Many researchers have theorized that if a tinnitus patient is treated early, with effective counseling and sound therapy, you may be able to mitigate the effects of the tinnitus before a patient reaches the ‘incapacitation’ stage.

Established sound therapy protocols
• Amplification alone - Searchfield, G.D.
• Tinnitus Activities Treatment - TAT Tyler, R.S. http://www.medicine.uiowa.edu/oto/research/tinnitus/
• Tinnitus Retraining Therapy - TRT Jastreboff, P.J. http://www.tinnitus-pjj.com/
• Cognitive Habituation Tinnitus Treatment – CHaTT http://www.tinnituspractitioners.org/about_us.aspx

Tinnitus counseling guide.
Traditional tinnitus treatment typically addresses the obvious symptom of tinnitus and often includes the use of audiological devices that can deliver sound therapies. While treatment of the tinnitus may reduce or alleviate the stressors associated with it, for example, depression, anxiety, and insomnia, many patients need additional help coping with these ancillary symptoms. Habituation to tinnitus can take between 12-18 months even with appropriate sound therapy; therefore, many patients return to their HCP feeling discouraged, frustrated, and desperate for more immediate relief. Unfortunately, what is often heard is, “There is nothing else that can be done” and “Learn to live with it.” Such messages can quickly diminish hope, leaving the patient feeling misunderstood and afraid that things cannot improve.

The clinician should emphasize to their patient that although there is no “cure” for tinnitus, there are effective, logical techniques that they can do to make tinnitus less noticeable and thereby improve their quality of life. There are a wide variety of tinnitus management counseling options available. These options range from providing basic education and information about tinnitus, to focused activities such as Cognitive Behavior Therapy (CBT), relaxation techniques, and meditation.
Counseling is an essential part of tinnitus treatment. The patient must understand what tinnitus is in order to overcome or avoid the negative associations that inhibit habituation. For some patients, a simple explanation of the causes of tinnitus and the relationship between hearing loss and tinnitus is enough to facilitate a positive outcome. For others, more in-depth systematic counseling may be necessary. This counseling may be provided by the HCP utilizing the various programs’ tools or it may be provided by a mental health professional upon referral.

In TRT, the link between the limbic system and the tinnitus is decreased by using a process called “directive counseling” or “demystification”. This involves a series of intense educational sessions where anatomy, physiology and real examples are discussed in story format to make the tinnitus phenomenon understandable and demystified [3]. For more information go to the TRT website: http://www.tinnitus-pjj.com/.

In TAT, counseling focuses on the whole person, and considers individual differences and needs. TAT provides structured counseling focused in four areas: thoughts and emotions, hearing and communication, sleep, and concentration in a picture-based approach that facilitates engagement of the patient.

TAT also engages the patient by including homework and activities to demonstrate understanding and facilitate progress. TAT counseling material is free for download and can be easily found at the University of Iowa website: http://www.medicine.uiowa.edu/oto/research/tinnitus/.

Cognitive Habituation Tinnitus Therapy (CHaTT©) was developed by Dr. Natan Bauman. CHaTT is a modified TRT program which also includes components of CBT, pictorial representation, and music as a form of distraction and relaxation. http://www.tinnituspractitioners.com.

With Progressive Tinnitus Management (PTM), developed for the Veteran’s Administration by James Henry, a hierarchal approach is used to determine whether a patient is a candidate for group counseling and sound therapy or a higher level of individual services including individual counseling by an audiologist and/or a mental health professional. All PTM-related information may be found at the government website: http://www.ncrar.research.va.gov/Education/Documents/TinnitusDocuments/Index.asp.

Many psychologists specialize in CBT which is commonly used in treating a patient’s psychological response to tinnitus. The HCP may consider a multidisciplinary approach to tinnitus treatment in which the HCP fits and adjusts the hearing instruments for effective sound therapy and provides the initial tinnitus counseling. This should include the anatomy of the ear, auditory system involved, and how tinnitus relates to hearing loss. Once sound therapy has begun, a psychologist may provide additional counseling and CBT to further support the emotional well-being of the patient.

We hope this guide provides useful reference material to help guide your tinnitus management practice, so that you may help your patients manage their negative reactions toward tinnitus, and improve their outcomes for a greater quality of life.

Conclusion

There are many forms of sound therapy for the treatment of tinnitus. Providing ear-level devices such as hearing aids, maskers, and combination devices are an accepted and researched part of sound therapy. Signia is leading the industry in the advancement of utilizing combination (hearing and tinnitus masker) instruments for acoustic tinnitus therapy. Signia has the largest portfolio of instruments available utilizing the most flexible therapy options in the industry. Whether your clinic follows a recognized protocol for tinnitus treatment, such as TRT /TAT, or you individualize your protocol for each patient, Signia products offer the flexible features you need as the HCP. The multifunction, software-based features are essential in providing a complete package that can be customized to meet the needs of all tinnitus sufferers. Since tinnitus therapy options are available in nearly all Signia products there is no additional cost associated with the sound therapy options and no special ordering requirements. For this reason, Signia is quickly becoming the number one choice for HCPs specializing in tinnitus treatment.

Using hearing protection in loud environments can help you avoid developing tinnitus
Resources


Programming the tinnitus therapy feature in Connexx®

I. Tinnitus Notch Therapy

Tinnitus Notch Therapy in primax is quick and easy to fit. Alternatively, a variety of therapy signals are also available in primax hearing instruments [14] that can be used with other tinnitus sound therapy strategies [15].

With the introduction of the Tinnitus Notch Therapy [16] for primax, a very narrow notch filter is applied to the frequency response of the hearing instruments. It is recommended that patients utilize Tinnitus Notch Therapy during the day as long as they are able for the best results. While some patients have shown improvement in as little as three weeks, it is more common to see significant benefit after three months, or even longer.

A. Fitting and fine tuning Tinnitus Notch Therapy

1. Who is a candidate for Tinnitus Notch Therapy?

Tinnitus Notch Therapy is in principle suitable for use with all patients experiencing subjective, tonal tinnitus. Tonal tinnitus encompasses all types of pure-tones like, whistling, ringing or humming sounds which originate internally and are only audible to the patient. Recent research on Tinnitus Notch Therapy has shown that this approach appears to be especially effective for patients suffering from severe tinnitus [17].

2. How to fit Tinnitus Notch Therapy - step-by-step

To implement Tinnitus Notch Therapy for patients using Signia hearing instruments, first perform a First Fit using the Connexx fitting software, and fine tune the settings as you would for any patient. Fine tuning should be completed, including programming any additional listening programs if required, prior to setting up Tinnitus Notch Therapy.

Next, open the Tinnitus tab on the left-hand navigation bar, and select Notch Therapy (Fig. 3).

The first and most important step to fitting Tinnitus Notch Therapy is the determination of the tinnitus frequency, also referred to as “pitch matching.” Since this measured frequency determines the proper placement of the notch filter, this step is critical in the success of Tinnitus Notch Therapy. We recommend following the Guided Matching approach for the highest efficiency.

In Connexx, pitch matching can be carried out in two ways:

a. Guided Matching: The tinnitus frequency is determined using a series of adaptive simple A-B comparisons [18]. The HCP plays Tone A and Tone B by pressing the corresponding button, and the patient determines which of the two sounds are more similar, i.e., closer in pitch to the perceived tinnitus.
The HCP can then select the corresponding tone and decide via (Fig. 4).

Note that for both Guided Matching and Manual Matching procedures, the tones are presented to both ears by default in bilateral fittings. The HCP may also choose to present tones to one ear only. In cases where the tinnitus is unilateral, contralateral tone presentation is recommended. In other words, if the tinnitus is heard only in the left ear, pitch matching should be carried out by presenting tones to right ear.

The underlying algorithm will automatically calculate the next appropriate presentation tones based on the selection. Test tones are played at an initial loudness of 5 dB SL, based on the patient’s audiogram. In case the presentation loudness is not suitable, it can be adjusted using the slider on the lower right (Fig. 5).

The procedure will automatically terminate as soon as the required accuracy has been reached, and the frequency check has been completed. (Fig. 6). The determined frequency is then directly used to activate the tinnitus notch for the desired listening programs.

This procedure may be repeated at any time via restart. Note that all current results will then be discarded, and the procedure starts anew.

Further information on matching the patients’ tinnitus frequency can be found in the More info on Notch Therapy accessible via on the left side of the page:

b. Manual Matching: Alternatively, the tinnitus frequency can also be determined manually, using a user control similar to the Connexx InSituGram function (Fig. 7), or via keyboard controls, as described in the Tinnitus Matching Instructions accessible via ?.

During Manual Matching, instruct the patient to direct the presentation of the tones (e.g. by saying “lower” or “higher”) in order to match the perceived tinnitus. The step size for neighboring frequencies can be selected between 1/3 and 1/6 octaves.
c. Direct Entry: The professional may also directly select a tinnitus frequency from a list and confirm it via [Use Frequency]. This can be especially helpful if the tinnitus frequency has already been determined previously (Fig. 8).

Final step during tinnitus pitch matching is a Frequency Check. This procedure is highly recommended as a final step during tinnitus pitch matching. It can correct a misjudgment of pitch by octaves, also referred to as octave confusion [19], which may often occur with untrained patients. The Frequency Check is very similar to the Matching procedure. Play Tone A, Tone B, and additionally Tone C, if available. Ask the patient to compare these three, and then choose via [Select] the tone most similar, i.e. closest in pitch, to the perceived tinnitus (Fig. 9).

This procedure consists of only one step and the selected tone is then confirmed as the final tinnitus frequency. The loudness of the presentation tones can be adjusted using the slider on the lower right. Note that the option for Tone C may be grayed out if the final octave step of the selected frequency is too high and lies beyond the measurable range.

Of course if necessary, the test can be repeated at any time via [Restart], in which case the previous results are discarded.

Activate Notch: As soon as the tinnitus frequency has been confirmed, Tinnitus Notch Therapy should be activated in all compatible listening programs via the checkbox for maximum effectiveness (Fig. 10).
Once the tinnitus notch has been applied in the program, it is readily visible to the HCP in the regular curve display as indicated with a yellow shaded region (Fig. 11).

Tinnitus Notch Therapy is different from the Tinnitus Signal program, which can be activated under Program Handling. The Tinnitus Signal program applies an additional tinnitus therapy signal and should be selected when implementing conventional tinnitus sound therapies (for an overview, see [15]). With the new Tinnitus Notch Therapy approach, a default program selection is not practical since the tinnitus frequency needs to be specifically determined before program activation.

3. Time-saving tips and strategies

- Before fitting Tinnitus Notch Therapy, it is recommended to conduct an individual First Fit to ensure an adequate amount of amplification, which is required for an effective application of the feature.
- Gain should exceed 10dB on the lower frequency side of the notch for the therapy to provide positive effects.
- For Tinnitus Notch Therapy, it is not required to match the loudness of the test tone to the tinnitus percept. The only requirement is to match the pitch of the test tone as closely as possible to the tinnitus percept, in order to position the notch at the correct frequency.
- The recently-introduced First Fit feature
  - Mimic fit - transfer session data to connected instruments can transfer settings of an existing hearing instrument fitting to another with different receiver types, families, and even platforms. When using this feature similar to the “Recalculate Fit” option during first fit, tinnitus settings in the initial device are automatically taken over to the new “target” hearing instrument, regardless of whether Tinnitus Notch Therapy or conventional sound therapy approaches have been followed.

4. Considerations on real ear measurements and verification

To verify the hearing instrument fitting after applying the tinnitus notch, or directly measure the effect of the notch on sound transmission via the hearing instrument, it is recommended to follow established protocols, e.g. [20] [21] for real-ear measurements. Since Tinnitus Notch Therapy only takes away amplification within a ½-octave around the tinnitus frequency, the filter effect can be seen directly in the measured frequency response. The position and depth of the notch can be seen most effectively by using a pure-tone sweep as test signal.

In general, when using non-speech signals for measuring the hearing instruments, the “test settings” function must be activated in Connexx in order to ensure that the selected test signal does not affect the measurement result. Otherwise, real ear measurements can be carried out as usual.

Note that since the applied notch is very narrow, speech intelligibility in daily life is not compromised.

5. Instructions for Tinnitus Notch

a. How to fine tune: As Tinnitus Notch Therapy depends highly on the correct determination of the tinnitus frequency, it is not recommended to conduct any manual fine tuning of the therapeutic notch itself beyond establishing the accurate tinnitus frequency. Of course the audiologist or HCP may modify in which programs the therapy is activated. Hearing instruments with Tinnitus Notch Therapy activated should be worn for at least 8 hours a day, at least 3 months before evaluating its effectiveness and benefit. This especially applies to patients with mild hearing losses and therefore fittings with low insertion gain. Since it is important to ensure sufficient amplification on the spectral edges of the notch, for these patients, it may be necessary to increase high frequency gain slightly, particularly on the lower frequency side of the notch, in order to improve its therapeutic effectiveness.

b. How to use other sound therapy approaches, and when to try them: If the patient does not suffer from tonal tinnitus, or if Tinnitus Notch Therapy has not proven effective after at least 6 months of use, conventional tinnitus sound therapy strategies using static or modulated broadband acoustic signals [15] are good alternatives for consideration (Fig. 12).

6. How do Signia tinnitus solutions fit into the treatment protocols?

As with various therapy approaches such as TRT or Progressive Tinnitus Management (PTM) [22], tinnitus severity may be assessed via standardized questionnaires such as Tinnitus Functional Index [23], Tinnitus Hearing Survey [24], or Self-Efficacy for Managing Reactions to Tinnitus [25].

Once the individual tinnitus frequency has been determined, the notch activated in the listening programs may help to reduce the perception of tonal tinnitus. This may be especially helpful as acknowledged protocols for managing hearing loss recommend combination instruments when patients also suffer from hearing loss.

Signia hearing instruments, which offer comprehensive solutions for hearing loss and tinnitus, provide the hearing care professional with the required tools for successful and efficient tinnitus management and treatment of hearing loss.
B. Resources

Tinnitus Notch Therapy - the novel and unique alternative therapy approach to treat tonal tinnitus - is easy to fit with Signia and Connexx. In addition, ample options for conventional treatment of tinnitus using different static and modulated broadband acoustic stimuli are also available. This comprehensive tinnitus treatment toolkit is a powerful asset for any hearing care professional working with tinnitus patients. It also fits particularly well within the VA’s Progressive Tinnitus Management Guideline. Tinnitus Notch Therapy can be incorporated into PTM as a tool to help veterans with tinnitus. The hearing care professional can choose among treatment options such as hearing aid amplification only, Tinnitus Notch Therapy, or Tinnitus Sound therapy.


II. Tinnitus Sound Therapy

The tinnitus therapy feature can function as an independent sound generator or in a mixed mode with both the hearing instrument microphone and sound generator active. The tinnitus feature provides several therapy signal options which can be activated for individuals as needed, including 5 different types of static noise, modulated noise with various timing and intensity options, as well as custom noise shaping by frequency handles, all of which allow for maximum flexibility.

1. **Select a noise type** (Fig. 13). The Hearing Care Professional (HCP) can select the noise type that is most comfortable to the wearer and/or offers the greatest relief of symptoms. The six noise types available are:

   - **White noise** – a signal with constant spectral density across all frequencies
   - **Pink noise** – each octave carries an equal amount of energy
   - **Speech noise** – corresponds to the frequency shaping of the Long-Term Average Speech Spectrum (LTASS)
   - **High Tone noise** – more intensity in the high frequency region
   - **Brownian noise** – power density decreases with increasing frequency
   - **Ocean waves†** – modulated noise presets that approximate ocean waves crashing on the beach. The four Ocean Wave signals (Paradise Beach, Rocky Beach, Boulder and Pebble Beach) are named after different types of beaches, and differ primarily in terms of the intensity and frequency of the modulation, or breaking waves. The Paradise Beach signal, developed together with world-renowned tinnitus treatment authority Dr. Pawel Jastreboff, is not a fully modulated signal, so there are no “silence gaps” between successive waves when tinnitus may become audible.

2. **Select output level** (Fig. 14). If the desire is to utilize a specific noise type, it is necessary to maintain the spectral characteristics of the noise by adjusting all the handles simultaneously. To increase therapy volume in all handles at the same time, utilize the Master Volume control in the tinnitus screen.

† Ocean sounds have long been felt to have a calming effect on the listener making them a great addition to the therapy options.
If desired, the HCP can create a personalized therapy signal by utilizing frequency shaping via the handles available in Connexx. The number of handles present for adjustment is dependent on the technology level of the hearing aid. For example (Fig. 15), a 7 level hearing aid has 20 handles for manipulation; the 5 level has 16 handles, the 3 level has 12 handles, and the 2 level instrument has 4 handles for therapy noise shaping.

Fig. 14. Master Gain handle for overall adjustment in a 7px hearing instrument

Fig. 15. Custom noise shaping example in a 7px instrument
III. General protocol for setting the therapy signal

The following are suggestions for programming the therapy signal if you are not following the guidelines of a specific tinnitus program such as TRT and TAT. Keep in mind that the therapy signal was designed to be flexible and can be adapted to fit the needs of virtually any established protocol including the ability to utilize the signal for the following:

- in one or both ears
- in one or multiple programs
- at different intensities in each ear
- at different intensities in each program
- with different noise types in each program and/or in each individual ear

The HCP may also give the patient a volume control to adjust the therapy signal independently from the hearing instrument gain volume. If you follow set protocols already using a different device, consult your Signia representative for individual instruction on how to program the therapy signal to suit your individual needs.

A. For patients that have tinnitus but no hearing loss:

When treating tinnitus without hearing loss, the Noise mode should be used. All Signia instruments can be used as a simple masker, when selecting which technology level to utilize (7, 5, 3, or 2) the amount of noise shaping desired is the primary consideration for these patients.

To activate the Noise only mode (Fig. 16):

1. Go to the Tinnitus menu.
2. Remove the check mark next to Mix with microphone. This activates the therapy signal only mode of the instruments.
3. Select type of noise or use a custom noise shape.
4. Gradually increase and decrease output for a comfortable mastering level.
5. If multiple programs with different noise types are desired; add additional programs choosing Tinnitus from the pull down menu in the Program Handling screen. You can even create custom names to each program once the program parameters are chosen as seen in the next screenshot.

B. For patients with tinnitus and hearing loss:

You can activate a therapy signal in the Universal program, if desired (Fig. 17 - see next page), in order to improve its therapeutic effectiveness:

1. First Fit the hearing instruments.
2. Under Program Handling, select Tinnitus.
3. Select Tinnitus and Sound Therapy.
4. Gradually increase and decrease master output for a comfortable mastering level.
5. Select Configuration and then Hearing Instrument to configure user control functionality for tinnitus therapy volume.
The majority of patients seen by HCPs need a form of combination treatment for hearing loss and tinnitus; for these patients, it is suggested to first try amplification only. For many patients with tinnitus (and hearing loss), simply wearing hearing aids mitigates the effects of their tinnitus. Remember, hearing aid use is a form of acoustic therapy. If the amplification of the natural environment is not sufficiently reducing the patient’s reaction to tinnitus, a designated hearing instrument program in a Mixed Mode (microphone+noise) can be activated. Typical set up will include one program with amplification alone and another program with the mixed mode.

When desired, the HCP can set up the instruments to allow the wearer adjustment of the tinnitus therapy volume via the rocker switch on board the instruments (for RICs and BTEs only), with a remote control, or via one of the Signia smartphone Apps.

C. To set up a tinnitus volume control

For on board therapy volume control, go to the Configuration Screen and Hearing Instrument (Fig. 18). Select Tinnitus Sound Therapy volume from the functionality pull down menu. Then choose the therapy volume range under Tinnitus Function.

The therapy signal volume can also be controlled via the touchControl. The apps work with the Signia instruments and are available for smartphones.

D. Setting the tinnitus therapy signal according to TRT and TAT:

The Tinnitus Retraining Therapy (TRT) is the clinical application of the neurophysiologic model. It uses a precise and individual combination of sound therapy and teaching /demystification / learning about tinnitus and hyperacusis mechanisms, with directions about how to return to normal life without provoking symptoms. It provides relief from tinnitus because it induces habituation to the tinnitus perception. TRT can be done in conjunction with amplification or alone in cases of normal hearing level. Counseling and sound are used to produce an enduring sense of reduced tinnitus after the cessation of sound. The mitigation of the tinnitus is due to the decline in response to familiar auditory stimuli (tinnitus) after to repeated exposure with no emotional reaction. Signia instruments are designed to work well for those HCP’s following a TRT approach (Jastreboff 1990).
**TRT protocol:**

To set the therapy signal, the HCP needs to look for the mixing point: the point where the noise mixes with the tinnitus, without masking it! The HCP can choose one type of the existing sounds and then adjust in an ascendant technique by utilizing the Master Gain handle, decrease the Master Gain until the therapy signal is no longer audible to the patient and then increasing the noise level until the patient says that the sound is mixed to tinnitus. The HCP has to explain to the patient that to achieve habituation, the noise should not cover the tinnitus, but that both sounds should be heard: the therapy sound and the tinnitus itself.

**TAT protocol:**

To set the therapy signal, the HCP should also use the ascendant technique and stop when the patient says the sound is audible and comfortable. Many patients report that broadband noise is easier to listen to than their tinnitus. While the goal here is not to find total masking or mixing point, it is possible to use total masking if the patient prefers it. The HCP can try one or two types of noise and at the end, choose what gives more relief at the lowest noise level.

The **Tinnitus Activities Treatment (TAT)** was implemented by Dr. Richard Tyler. This approach is also well supported by the Signia solutions. TAT is a treatment for the reaction to tinnitus that also uses counseling, sound therapy and other activities based on cognitive behavioral therapy (Fig. 19). In this case, counseling is structured into four topics:

1. Thoughts and Emotions
2. Hearing and Communication
3. Sleep
4. Concentration.

The sound therapy aims to decrease the prominence of tinnitus and facilitate habituation.

---

*Fig. 18. Configuration menu-Hearing Instrument with “Tinnitus Therapy volume” chosen on the right side rocker switch and a tinnitus function range of 16 dB*

*Fig. 19.*
IV. Therapy signal alternatives

Acoustic therapy does not always have to result in activating a noise therapy signal in the device or following an established tinnitus treatment protocol. Amplification via hearing instruments alone is a common treatment for tinnitus patients and is often the starting recommendation by the HCP. Although many advanced features improve sound quality and comfort for traditional hearing aid wearers, they may be counterproductive for tinnitus patients resulting in being too quiet in quiet settings.

When the treatment goal for your tinnitus patient is habituation, a standard recommendation is to avoid silence. To help achieve this goal, Signia offers some unique algorithm options for these tinnitus sufferers. We will explore these algorithms in the order that they appear within the Connexx software:

1. **Gain for soft sounds** - Some tinnitus patients will prefer a slight increase in soft level gain (Fig. 20). This can be done over all frequencies in the Basic Tuning screen, as seen below, or in a particular frequency region via the Compression tab under Fine Tuning.

2. **Sound Equalizer** (Performance level 7 only) - Under Personalization > Sound Equalizer, select Quiet and increase gain (Fig. 21). This change would happen automatically when a quiet situation is detected and can help ensure that the patient has adequate environmental stimulation at all times.

3. **Sound Management** - If the desire is for the environment to provide natural masking noise for your patient, you may choose to reduce or eliminate some of the noise reduction features (Fig. 22A and 22B).

- All Signia instruments provide some level of noise reduction as a default. Consider reducing the level of noise reduction for patients with tinnitus.

- In some cases, it may be advantageous to give the patient a second dedicated program where digital noise reduction (DNR) is turned off. Suggest that the patient switch to this second program when in quiet situations and speech is not the primary focus. They can then return to their regular Universal program when communication is the priority (Fig. 23).
  a. Select **Program Handling**.
  b. In Program 2 select **Universal**.
  c. While in Program 2 go to **Fine Tuning** and then **Sound Management**.
  d. Deselect **Speech and Noise Management**.

4. **Microphone/Audio** - The microphone array chosen for patients whose primary concern is tinnitus may vary from a patient that does not have tinnitus. Hearing impaired patients without tinnitus tend to prefer a quiet world with primarily speech amplified. As mentioned earlier, for a tinnitus patient, this can be counterproductive. The HCP may choose alternative trigger points for the directional microphone modes and varying levels of directionality.

- The settings menu in the directional microphone section allows a HCP to set the hearing aids to three levels of soft level directivity (Fig. 24):
  a. Select **Fine Tuning** and then **Microphone Audio**.

![Fig. 20. Basic Tuning screen adjustment to increase soft sound gain](image-url)
b. In the directional box select **Settings** via the wrench icon.
c. Low-less noise than standard is needed to move the hearing instrument into a full directional pattern (Full directionality is achieved in lower noise level).
d. Standard - the default level of noise needed to move a hearing instrument into a full directional pattern.
e. High - Higher noise level is required for the hearing aid to change into a directional pattern. For tinnitus patients this higher trigger point may be preferred.

- A wearer with tinnitus may find they prefer the hearing instrument to stay in an omnidirectional mode when their tinnitus is more intense. This can also be achieved easily by adding a second program and disabling the directional processing.

While in **Program 2**, select **Fine Tuning** and then **Microphone Audio**. Deselect all microphone options except TruEar (Fig. 25).

There is no right or wrong combination of the aforementioned features as the patient’s reaction to the configuration of a particular hearing instrument is subjective when it comes to tinnitus treatment. It is recommended that the HCP try different combinations of features at various settings to find the preference of each patient using a multiple program technique.

![](Fig. 21.png)

**Fig. 21.**

![](Fig. 22A.png)

**Fig. 22A.** Fine Tuning adjustment for noise reduction degree of noise attenuation

![](Fig. 22B.png)

**Fig. 22B.** Fine tuning change from broadband noise reduction to multichannel noise reduction

![](Fig. 23.png)

**Fig. 23.** Disable Speech and Noise Management in second Universal program.

![](Fig. 24.png)

**Fig. 24.** Changing the Soft Level Directivity sensitivity to High meaning more noise is needed to activate directionality

![](Fig. 25.png)

**Fig. 25.** Microphone/Audio with de-selected directional processing in a second program.
V. The use of accessories for tinnitus relief and relaxation

With advancements in hearing instruments came the advancement of wireless connectivity. Stream audio signals from a television, DVD player, MP3 player, Bluetooth®-enabled cell or landline phone.

To help manage tinnitus or enhance relaxation

Download Apps to the wearer’s Smartphone, iPod, iPad, tablet and/or computer and stream these relaxing sounds to the hearing instruments.

A quick search in the App stores for “Tinnitus”, “Relax”, or “Audio” will direct you to some interesting Apps:

1. Bloom: “Zen”-sounding tones, but presented in stereo

2. Relax Noise 3: Masks nerveing ambient noise and also your tinnitus with white noise ... In nature, it sounds similar to waterfalls, heavy rainfalls or the sounds of the sea. https://play.google.com/store/apps/details?id=de.xipa.rnoise&hl=en

3. Nature space: A holographic audio journey (free, but extra tracks may be purchased)

4. Relax melody samples: relaxing sounds of nature

5. Ambiance: A huge catalog of sounds, everything from white, pink, and blue noise to fan noise, animal sounds, and crowd noise

6. Easy relax ultimate: Allows the user to choose a base background sound and then layer up to three additional sounds, all with adjustable volume and durations; plus, one can add a binaural beat in the background.

The App stores offerings change regularly so you never know what kinds of sounds a new search will bring!
# Tinnitus Handicap Inventory (THI)

Name: ___________________________________________ Date: ______________

**Instructions:** The purpose of this questionnaire is to identify, quantify, and evaluate the difficulties that you may be experiencing because of tinnitus. Please do not skip any questions. When you have answered all the questions, add up your total score, based on the values for each response.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Because of your tinnitus, is it difficult for you to concentrate?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Does the loudness of your tinnitus make it difficult for you to hear people?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Does your tinnitus make you angry?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Does your tinnitus make you feel confused?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Because of your tinnitus, do you feel desperate?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Do you complain a great deal about your tinnitus?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Because of your tinnitus, do you have trouble falling asleep at night?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Do you feel as though you cannot escape your tinnitus?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Does your tinnitus interfere with your ability to enjoy your social activities (such as going out to dinner, to the movies)?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Because of your tinnitus, do you feel frustrated?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Because of your tinnitus, do you feel that you have a terrible disease?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Does your tinnitus make it difficult for you to enjoy life?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Does your tinnitus interfere with your job or household responsibilities?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Because of your tinnitus, do you find that you are often irritable?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Because of your tinnitus, is it difficult for you to read?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Does your tinnitus make you upset?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Do you feel that your tinnitus problem has placed stress on your relationships with members of your family and friends?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Do you find it difficult to focus your attention away from your tinnitus and on other things?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Do you feel that you have no control over your tinnitus?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Because of your tinnitus, do you often feel tired?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Because of your tinnitus, do you feel depressed?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Does your tinnitus make you feel anxious?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Do you feel that you can no longer cope with your tinnitus?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Does your tinnitus get worse when you are under stress?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Does your tinnitus make you feel insecure?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Total THI Score: (number of ‘Yes’ responses x 4) + (number of ‘Sometimes’ responses x 2) = ___________

Determine presence of perceived tinnitus handicap based on total THI score.

<table>
<thead>
<tr>
<th>Score</th>
<th>Handicap Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-16:</td>
<td>Slight or no handicap (Grade 1)</td>
</tr>
<tr>
<td>18-36:</td>
<td>Mild handicap (Grade 2)</td>
</tr>
<tr>
<td>38-56:</td>
<td>Moderate handicap (Grade 3)</td>
</tr>
<tr>
<td>58-76:</td>
<td>Severe handicap (Grade 4)</td>
</tr>
<tr>
<td>78-100</td>
<td>Catastrophic handicap (Grade 5)</td>
</tr>
</tbody>
</table>

This questionnaire is reproduced with the kind permission of Craig Newman, Ph.D.

References:


Tinnitus primary function questionnaire


Name: ____________________________ Date: ______________

Please indicate your agreement with each statement on a scale from 0 (completely disagree) to 100 (completely agree)

<table>
<thead>
<tr>
<th>Question</th>
<th>0 - 100 complete disagree</th>
<th>0 - 100 completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel like my tinnitus makes it difficult for me to concentrate on some tasks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I have difficulty focusing my attention on some important tasks because of tinnitus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. My inability to think about something undisturbed is one of the worst effects of my tinnitus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. My emotional peace is one of the worst effects of my tinnitus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I am depressed because of my tinnitus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I am anxious because of my tinnitus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. My tinnitus masks some speech sounds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. In addition to my hearing loss, my tinnitus interferes with my understanding of speech.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. One of the worst things about my tinnitus is its effect on my speech understanding, over and above any effect of my hearing loss.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I am tired during the day because my tinnitus has disrupted my sleep.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I lie awake at night because of my tinnitus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. When I wake up in the night, my tinnitus makes it difficult to get back to sleep.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Tinnitus Case History Questionnaire (TCHQ)

Name: __________________________________________________________________________ Date: _________________
Date of birth: _________________

**Instructions:** Place an “X” next to the correct item that best matches your symptoms or write an answer to the specific questions.

<table>
<thead>
<tr>
<th>1. Age: ______</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2. Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Male</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Handedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ right</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Is there a family history of tinnitus complaints?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ YES</td>
</tr>
</tbody>
</table>

| 5. Initial onset: When did you first experience your tinnitus? | ________________________________________________________________________________ |
| --- |

<table>
<thead>
<tr>
<th>6. How did you perceive the beginning?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ gradual</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. Do you know what caused the initial onset?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ loud blast of sound</td>
</tr>
<tr>
<td>□ other: ____________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8. Does your tinnitus seem to <strong>PULSATE</strong>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ YES with heart beat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9. Where do you perceive your tinnitus?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ right ear</td>
</tr>
<tr>
<td>□ both ears, equally</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10. How does your tinnitus manifest itself over time?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ intermittent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11. Does the <strong>LOUDNESS</strong> of the tinnitus vary from day to day?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12. Describe the <strong>LOUDNESS</strong> of your tinnitus using a scale from 1 (very faint) to 100 (very loud): __________</th>
</tr>
</thead>
</table>

| 13. Please describe, **IN YOUR OWN WORDS**, what your tinnitus usually sounds like. Examples include: hissing, ringing, pulsing, buzzing, roaring, rushing, typewriter, whistling, whooshing. | ____________________________________________________________________________ |
14. Does your tinnitus sound more like a tone or more like noise?
- [ ] tone
- [ ] noise
- [ ] crickets
- [ ] other

15. Please describe the PITCH frequency:
- [ ] very high
- [ ] high
- [ ] medium
- [ ] low

16. What percent of your total awake time, over the last month, have you been aware of your tinnitus? ____%

17. What percent of your total awake time, over the last month, have you been annoyed, distressed, or irritated of your tinnitus? ____

18. How many different treatments have you undergone because of your tinnitus?
- [ ] none
- [ ] one
- [ ] several
- [ ] many

19. Is your tinnitus reduced by music or by certain types of environmental sounds, such as the noise of a waterfall or running water when you are standing in the shower?
- [ ] YES
- [ ] NO
- [ ] I don't know

20. Does the presence of loud noise make your tinnitus worse?
- [ ] YES
- [ ] NO
- [ ] I don't know

21. Does any head and neck movement (e.g. moving the jaw forward or clenching the teeth) or touching of your arms/hands or head affect your tinnitus?
- [ ] YES
- [ ] NO

22. How does a nap during the day affect your tinnitus?
- [ ] worsens it
- [ ] reduces it
- [ ] has no effect

23. Is there any relationship between sleep at night and your tinnitus during the day?
- [ ] YES
- [ ] NO
- [ ] I don't know

24. How does stress influence your tinnitus?
- [ ] worsens it
- [ ] reduces it
- [ ] has no effect

25. Does medication have an effect on your tinnitus?
- [ ] YES
- [ ] NO
- [ ] I don't know

If YES, list medication with effect / details: _________________________________

26. Do you think you have a hearing problem?
- [ ] YES
- [ ] NO

27. Do you wear hearing aids?
- [ ] right
- [ ] left
- [ ] both
- [ ] NO

28. Do you have a problem tolerating sounds that other people around you find comfortable but you find them to be too loud?
- [ ] never
- [ ] rarely
- [ ] sometimes
- [ ] usually
- [ ] always

29. Do sounds cause you pain or physical discomfort?
- [ ] YES
- [ ] NO
- [ ] I don't know

30. Do you suffer from headaches?
- [ ] YES
- [ ] NO

31. Do you suffer from vertigo or dizziness?
- [ ] YES
- [ ] NO

32. Do you suffer from temporomandibular disorder?
- [ ] YES
- [ ] NO

33. Do you suffer from neck pain?
- [ ] YES
- [ ] NO

34. Do you suffer from other pain syndromes?
- [ ] YES
- [ ] NO

35. Are you currently under treatment for psychiatric problems?
- [ ] YES
- [ ] NO
Bios

Vera Wolf

Dipl.-Ing. (FH), is an Audiological Engineer for Sivantos, the manufacturer of Signia hearing aids. She is responsible for feature optimization within the audiology system development team. Mrs. Wolf holds a diploma in Engineering for Audiology and Hearing Technology from the University of Applied Sciences in Oldenburg, Germany. Prior to joining Sivantos (formerly Siemens Audiology), she worked as a clinical pediatric audiologist at the University Clinic in Mainz, Germany.

Leanne Powers, Au.D.

Dr. Powers is an Education Specialist for Signia. She trains customers and staff on products, software, and services. In this role, Leanne has given several lectures at AudiologyNOW! and numerous state conventions on a variety of topics, including compression in modern hearing instruments, frequency compression, and tinnitus therapy, as well as presentations specific to the company’s technology. Leanne practiced in a variety of hearing healthcare settings for 16 years prior to joining the Signia team. Most recently, she operated two hearing aid offices in the Chicago area. Leanne received her undergraduate degree from Northern Illinois University, her graduate degree from RUSH University in Chicago, and her doctorate from A.T. Still University of Health Sciences in Arizona.

Jennifer Gehlen, Au.D.

Dr. Gehlen is an Educational Specialist at Signia. She provides training to customers and staff on company technology, products, and software from face-to-face meetings to virtual sessions. She holds an Au.D. from the University of Florida, where she also received her undergraduate and master’s degrees. At Signia, she has previously held the roles of staff audiologist for manufacturing and customer support, and field training consultant. She has practiced audiology and hearing aid fitting in a variety of clinical settings in northern California and in the Tampa Bay, Florida area since 1993.