

TINNITUS PERCEPTION HABITUATION AND RETRAINING THERAPY INFORMATION FOR TINNITUS SUFFERERS

HOW WE HEAR

Conscious awareness of sound takes place near the surface of the brain when a pattern of electrical activity traveling up the nerve of hearing from the ear reaches a point just below the auditory cortex. The hearing nerve has about 10,000 different fibres, and patterns of electrical activity in these fibres are matched with other patterns which are held in the auditory or hearing memory. The cochlea, or inner ear which changes sound waves into these electrical patterns is a surprisingly noisy place, where continuous mechanical and electrical activity in 17,000 hair cells can now be monitored with sensitive, computer enhanced, listening devices. Most of what we hear is a sequence of sounds, like speech or music. There is a continuous process of matching one familiar pattern with the one coming from the ear. Each time a pattern from the ears is matched with a pattern in the auditory memory we have the experience of hearing a sound. Putting together these matched patterns starts a process of evaluation. Another part of the brain, close to the hearing centre, is involved in the meaning of what we hear, and in interpreting the language. If it's a foreign language, we can hear the sound but may not understand the meaning.

THE MEANING OF SOUND

Sound is of enormous importance in monitoring our environment. Hearing in animals (who are constantly in fear of their lives because of attacks from predators) has to be very sensitive and specific. The ability of animals to develop extremely acute hearing, by which they could detect the very small sounds of an attacker a long way off contributed to the survival of that species. These warning signals produce acute anxiety, prompting appropriate action to avoid attack, the so-called survival reflex. Some sounds can be identified as warning signals, while others can evoke a feeling of security or pleasure. We have this experience every day with sounds that alarm us such as traffic horns and sounds that soothe us such as music, or the sounds of nature.

The auditory pathways in our brain have large numbers of connections with the limbic system, which is concerned with emotion and learning. Each sound that we hear and learn the meaning of, has an 'emotional label' attached to it, which may change from time to time according to how we feel in ourselves and the context we hear them in. For example the sound of a neighbour's television set may be acceptable, or unpleasant and intrusive, depending on whether it belongs to a well loved friend or relation, or somebody else who, for various reasons, we dislike.

THE MEANING OF TINNITUS SOUNDS

About 85% of those who experience tinnitus do not find it intrusive, disturbing or anxiety provoking (something tinnitus sufferers find very hard to believe!) The reason for this is not so much because the quality or loudness of the tinnitus is different; in fact we have found that tinnitus is a very similar type of sound in those who are bothered by it and those who are not. The main difference is that those who find tinnitus troublesome, evaluate and perceive it as a threat, or at the very least an annoyance, rather than something of little or no consequence. Just as the animal alerted to danger by the sound of a predator focuses solely on that sound in order to survive, so those who consider that tinnitus is a threat or warning signal are unable to do anything but listen to it. It is part of the mechanism that humans have developed of self preservation, although clearly in this situation it is not working to our advantage! Many people complain of the loss of silence, something they previously greatly treasured and enjoyed, before tinnitus became persistent.

TINNITUS AS A NEW EXPERIENCE

When tinnitus first emerges it is a new signal, there are no memory patterns, and no means of categorising it. Any new experience tends to produce a feeling of discomfort, due to a loss of the 'status quo' and a change in what was previously a stable environment (change in 'homeostasis'). Until proper evaluation has been undertaken of what tinnitus means, it will be regarded with understandable suspicion. Many 'sufferers' only experience mild annoyance from tinnitus as a result of this mechanism, but it may be sufficient to promote the need to seek help.

TINNITUS AS A THREAT

For many tinnitus patients tinnitus is quite threatening. Some people fear that tinnitus means they have some kind of serious illness. There are patients who worry about the possibility that it heralds a brain tumour, blood clot, or some serious mental illness ('it will drive me mad!') These anxieties are almost always unfounded. Many people fear that tinnitus will get louder, continue for ever, and cannot be cured. Even the concept that tinnitus is

invading one's 'right to silence' constitutes a threat, very similar to the territorial invasions that animals experience. It is often feared that tinnitus will continue to spoil peace and quiet, interfere with concentration at work, quiet recreational activity and ability to sleep at night.

Unfortunately these fears may be enhanced by professional advice. Many doctors and other professionals still advise patients that there is nothing that can be done about tinnitus and that it will go on for ever. Other people fear that tinnitus may mean that their hearing is becoming impaired, although the tinnitus may be the consequence of a mild hearing impairment rather than the other way around. In any event the threatening qualities of the tinnitus are enhanced. Finally many tinnitus sufferers are angry about the treatment, or lack of treatment, or inappropriate advice that they have received. They may feel guilty for having submitted to treatment which they think is the cause of their tinnitus. Fear, anger and guilt are very powerful emotions which are intended to enhance survival style reflex activity and consequently greatly increase attention on the tinnitus. In our experience, tinnitus improves when the patient overcomes these feelings and stops dwelling on thoughts of injustice.

TINNITUS AS A PHOBIC STATE

In some patients extreme fear of tinnitus results in a phobic state developing very similar to that of the fear of spiders, small spaces, flying etc. Many tinnitus sufferers also have these phobias, suggesting common mechanisms at work. In any phobic state a slow process of "desensitisation" has to be used, confronting the feared object, and learning first to tolerate it, and then to accept it as a normal phenomenon that does not in any way threaten. Many aspects of tinnitus retraining therapy are common to these techniques.

TINNITUS RETRAINING THERAPY

Successful tinnitus management is a result of retraining and relaxing. Once the tinnitus loses its sinister meaning, however loud it has been or however unpleasant it may seem, it DOES begin to diminish, and in many cases may not be heard for long periods of time. In most cases firmly held beliefs are hard to change. Retraining the auditory system to accept tinnitus as something that occurs naturally, does not spell a lifetime of torture and despair, and is not a threat or a warning signal, can take months sometimes even years. Such retraining should be guided by professionals with experience in this field forming part of multidisciplinary team. For people who also have co-existing or pre-existing anxiety or depression it can take longer to change their feelings about their tinnitus.

When we talk about retraining, this is not simply an abstract learning exercise. In the subconscious part of the brain concerned with hearing, beyond the inner ear, but before the act of conscious perception of sound takes place, networks of nerve cells (neuronal networks) are programmed to pick up signals on a 'need to hear' basis. Think of the way we invariably detect the sound of our own name, whereas we may be unaware of the sound of rain pounding on the roof or surf beating on a sea shore. Retraining therapy involves reprogramming or setting these networks which are selectively picking up inner ear 'nature sounds' because they have been identified as a threat, either to life, or life quality.

Tinnitus retraining first involves learning about what is actually causing the tinnitus. This begins with proper examination by an ear specialist followed by a full explanation of what is going on in the ear and the brain to produce the tinnitus sound. However, specialists who themselves believe that tinnitus is an 'ear' phenomenon cannot help. We need to learn that the sounds of tinnitus which we may interpret as distressing, affecting life quality, and seemingly unending, are, in reality the sounds of nature coming from the ear. They are often generated by hair cell activity that has been there throughout life but which as a result of minute changes in neural tuning in the brain, is now wrongly identified as a threat. With appropriate counseling (or 'retraining') from professionals, we can change even strongly held views that tinnitus is a threatening and unpleasant experience which cannot be altered.

The presence of any continuous stimulus usually results in a process called habituation, whereby the individual responds less to the stimulus, as long as it does not have any special negative meaning. The final stage in this process is when the signal is no longer detected. With tinnitus this means that it is no longer heard, even if it is listened for. Retraining therapy can achieve this. The process takes a long time (often 2 years or so). In the initial stages, however, tinnitus becomes gradually less unpleasant (but may still be loud), and produces a weaker emotional response. This process is called habituation of reaction. Tinnitus then becomes quieter for longer periods of time, and eventually disappears or becomes a natural part of the background 'sound of silence' (habituation of perception).

HEARING LOSS AND TINNITUS

One way in which the ear itself does contribute to tinnitus is if there is a hearing loss. This may be quite slight, or just in the high frequencies. Any tendency to 'straining to hear' can increase amplification of sound signals in the subconscious part of the brain, and increase the ease by which tinnitus signals can be picked up from the

cochlea. A hearing loss can also result in a greater contrast between the tinnitus sound and environmental sounds which become faint. This is why it is very important to correct a hearing loss when relevant, with an appropriate hearing aid, as part of overall tinnitus management. In a certain cases, changes in inner ear function may be important in triggering tinnitus emergent. Despite the importance of hearing loss, a recent study of tinnitus clinic patients showed there was no significant difference in hearing between the tinnitus group and the normal population statistics. It is important to distinguish between the role of the ear in the EMERGENCE of tinnitus (e.g. disco tinnitus) and the role of central processing in the brain in the determining PERSISTENCE of tinnitus and emotional response to it.

HABITUATION DEVICE

Habituation to any signal cannot occur when it is absent. Much better long-term results can be obtained if white noise is used at low intensities while the tinnitus can be heard at the same time. White noise contains all frequencies, and therefore very gently stimulates all the nerve cells in the subconscious networks, allowing them to be more easily programmed, or reset, so that tinnitus signals are not longer detected.

SILENCE IS FAR FROM GOLDEN

In 1953 Heller and Bergman performed an experiment placing 80 normally hearing individuals in a sound proofed room for 5 minutes each, asking them to report on any sounds that might be heard. 93% reported hearing tinnitus, although none had experienced it before. Emergence of tinnitus is highly dependent on silence. Most tinnitus is first heard at night in a well sound-proofed bedroom, or a quiet living room. Persistence of tinnitus depends on the meaning attached to it, but also to the contrast it creates with the auditory environment. Contrast contributes greatly to the intensity of any perception. Thus a small candle in the corner of a large darkened room seems dazzlingly bright until flood lights are switched on making it virtually unnoticed. Tinnitus patients should avoid extreme silence and retraining programmes will often use white noise therapy as a means to reduce this contrast.

Some tinnitus patients have hyperacusis (sensitivity to external noise) and for this reason often seek very quiet environments. In this respect they are their own worst enemy! Hypersensitivity to external sound involves a very similar mechanism to tinnitus annoyance. The brain treats external sounds, specially those of similar frequency to the tinnitus, as having the same negative properties. Often hyperacusis predates distressing tinnitus, we recognise it as a 'pre-tinnitus' state where long standing dislike of certain environmental sounds leads to inevitable distress and dislike for internally generated sounds when they become detected.

Although using white noise on its own can give some temporary relief from tinnitus discomfort, unless it is combined with the retraining approach, there is very little chance of permanent relief. Where strong beliefs about the threatening nature of tinnitus are maintained, the survival mechanisms in the subconscious ensure that it continuously monitored and heard.