

Tonic Tensor Tympani Syndrome (TTTS)

<http://www.dineenandwestcott.com.au/hyperacusis.php?fid=1>

Retrieved 15th May 2009

In the middle ear, the tensor tympani muscle and the stapedial muscle contract to tighten the middle ear bones (the ossicles) as a reaction to loud, potentially damaging sound. This provides protection to the inner ear from these loud sounds.

In many people with hyperacusis, an increased, involuntary activity can develop in the tensor tympani muscle in the middle ear as part of a protective and startle response to some sounds. This lowered reflex threshold for tensor tympani contraction is activated by the perception/anticipation of sudden, unexpected, loud sound, and is called tonic tensor tympani syndrome (TTTS). In some people with hyperacusis, it appears that the tensor tympani muscle can contract just by thinking about a loud sound.

Following exposure to intolerable sounds, this heightened contraction of the tensor tympani muscle:

- tightens the ear drum
- stiffens the middle ear bones (ossicles)
- can lead to irritability of the trigeminal nerve, which innervates the tensor tympani muscle; and to other nerves supplying the ear drum
- can affect the airflow into the middle ear. The tensor tympani muscle functions in coordination with the tensor veli palatini muscle. When we yawn or swallow, these muscles work together to open the Eustachian tube. This keeps the ears healthy by clearing the middle ear of any accumulated fluid and allows the ears to “pop” by equalising pressure caused by altitude changes.

TTTS can lead to a range of symptoms in and around the ear(s): ear pain; pain in the jaw joint and down the neck; a fluttering sensation in the ear; a sensation of fullness in the ear; burning/numbness/tingling in and around the ear; unsteadiness; distorted hearing. TTTS is often associated with the development of temporary tinnitus or an increase/change in pre-existing tinnitus.

It does not harm the ear to experience TTTS, and even though the TTTS symptoms can seem as if the ear is being damaged by some sounds, this is not the case. Moderate, everyday sounds are quite safe and do not harm the ear or cause a hearing loss.

TTTS-like symptoms may be due to middle or inner ear pathology, and medical investigation should be carried out to exclude this possibility, particularly if severe vertigo is an associated symptom. Conversely, TTTS symptoms in people with hyperacusis can be mistakenly diagnosed as due to middle/inner ear pathology or temporomandibular (jaw) joint disorder (TMD).

TMD can produce an episodic or constant spasm of the tensor tympani muscle, with referred ear pain and other TTTS symptoms shown to be present in up to 42% in patients with TMD. In this case, TTTS is a secondary consequence of physical dysfunction of the jaw joint; the TTTS symptoms do not tend to escalate and hyperacusis is not necessarily present.

With TTTS associated with hyperacusis, the primary cause is related to the way sound is perceived in the brain. Hyperacusis clients with severe TTTS can develop TMD as a secondary consequence, due to the tension and strain on the muscles in and around the ear.

It is therefore important for people with hyperacusis who experience these symptoms to consult an Ear, Nose and Throat specialist/TMD specialist to ensure there is no underlying medical condition causing them.

As TTTS develops from the way intolerable sound is perceived in the brain, using strategies aiming for hyperacusis desensitisation will help reduce TTTS symptoms.

How is the brain involved in the development of hyperacusis?

P Jastreboff's neurophysiological model of tinnitus and hyperacusis:

As part of the processing of sound in the brain, all sounds are evaluated subconsciously with regard to their meaning or importance to us. Sounds that are considered important (in either a positive or negative way) will be transmitted to

the more conscious parts of our brain, while unimportant sounds remain "half heard".

If a sound acquires a negative association, the limbic system in the brain becomes activated, inducing fear or irritation. The autonomic nervous system also becomes activated, provoking the "fight or flight" reaction. A conditioned response develops so that repetition of this sound enhances the activation of the limbic and autonomic systems. In people with significant hyperacusis, many sounds are evaluated in the subconscious as potentially threatening, leading to the possible development of TTTS symptoms from the subconscious need to protect the ear.

Our brain is a highly plastic organ, constantly reorganising and developing new neural connections. This means that we are able to retrain our brain to reverse the process which has led to hyperacusis and tinnitus distress.