TONIC TENSOR TYMPANI SYNDROME (TTTS) 
& ACOUSTIC SHOCK

Background
In the early 1990s, coinciding with the rapid growth of call centres in Australia, increasing numbers of call centre employees were reporting an unusual cluster of symptoms following exposure to a sudden, unexpected, loud sound (called an acoustic incident) randomly transmitted via the telephone line. A similar pattern was being noticed overseas. These neurophysiological and psychological symptoms are different to those occurring with a traditional noise injury. They include a shock/trauma reaction, and some or all of the following: pain in and around the ear; other physical sensations including blockage in the ear and burning/numbness in and around the ear; tinnitus; hyperacusis (sound intolerance); and mild vertigo.

The increased numbers of people reporting this specific and consistent pattern of symptoms following acoustic incident exposure led to further research, and the term acoustic shock was developed to identify the presence of these symptoms, with acoustic shock disorder (ASD) the term used to identify persistence of this symptom cluster.

Call centre staff using a telephone headset or handset are vulnerable to ASD because of the increased likelihood of exposure, close to their ear(s), to an acoustic incident, and the research on ASD to date has focused on this group. However, any person who has developed tinnitus and hyperacusis, particularly following exposure to a sudden/unexpected/loud sound, may report some or all of these symptoms. The symptoms can range from mild to severe, and can be of brief duration or persistent.

What is TTTS?
We have two muscles attached to the tiny ossicles (bones) in the middle ear: the stapedius muscle (attached to the stapes or stirrup bone) and the tensor tympani muscle (attached to the malleus bone). These muscles provide protection to the inner ear from loud, potentially damaging sounds, by contracting to tighten the ossicles. This limits transmission of these sounds to the inner ear.

Researchers looking for a physiological explanation of the more unusual symptoms of ASI observed that they were consistent with a condition called tonic tensor tympani syndrome (TTTS), originally described by ENT specialist Dr I. Klockhoff in the 1960/70s. It was proposed that the primary cause of ASD is due to excessive and persistent middle ear muscle contractions, in particular tensor tympani contraction.

With ASD and in many (but not all) people with hyperacusis/tinnitus related anxiety, an increased, involuntary activity appears to develop in the tensor tympani muscle in the middle ear as part of a protective and startle response to intolerable sounds.

TTTS can be considered to develop from a subconscious need to protect the ear.
What are the effects of TTTS?

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.

As a result, TTTS can cause a range of symptoms in and around the ear(s). These can include:

- a sensation of popping/clicking in the ears
- the development of temporary tinnitus or an increase/change in pre-existing tinnitus
- pain in and around the ear
- a fluttering sensation in the ear
- a sensation of fullness in the ear
- burning/numbness in and around the ear
- unsteadiness, “like being on a boat”, rather than the spinning sensation associated with more severe vertigo
- distorted hearing
- nausea
- headache

For people with severe hyperacusis/tinnitus related distress, some/many/all of these symptoms may be present most of the time, and increase following exposure to intolerable sounds. For others, some/many/all of these symptoms may develop for a period of time after exposure to intolerable sounds.
How should I deal with TTTS symptoms?

TTTS-like symptoms may be due to middle or inner ear pathology, and medical investigation should be carried out to exclude this possibility. This is particularly indicated if severe vertigo is an associated symptom to exclude inner ear conditions such as Meniere’s disease, perilymph fistula or superior canal dehiscence. Conversely, TTTS symptoms in people with hyperacusis are, in my experience, often mistakenly diagnosed as due to middle/inner ear pathology or jaw joint disorder.

Jaw joint dysfunction can potentially lead to temporomandibular 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 about 40% of patients with TMD. When TTTS is a secondary consequence of TMD and/or 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. I have, however, had hyperacusis clients with severe TTTS develop TMD as a secondary consequence, due to the tension and strain on the muscles in and around the ear.

Once you have received an assurance that your ear is healthy, the ear symptoms you are experiencing associated with tinnitus/hyperacusis/ASD can then be considered to be due to TTTS. This mechanism has not been definitively proven, and is not widely understood in the medical profession. However, it gives a logical (and the only available) explanation of the symptoms. In my experience, it is entirely consistent with the clinical picture presented by many tinnitus/ASD/hyperacusis clients.

It does not harm the ear to experience TTTS.

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

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