



# the Trumpeteer

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## Eustachian Tube Dysfunction: New Treatment Options

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The Eustachian tube (ET) is a small muscular structure connecting the middle ear to the back of the nose. Its purpose is to equalize the middle ear air pressure with environmental air allowing the hearing bones to vibrate freely. When the tube can't open for whatever reason, patients experience their ears clogging or develop ear pain and fullness. The tube normally opens for a fraction of a second about once every 3 minutes in response to swallowing or yawning. The opening sensation patients feel is the same when landing in an airplane or coming down an elevator. Eustachian tube dysfunction (ETD) occurs when the tube isn't working well. This article reviews some of the features of this common problem and new treatments.

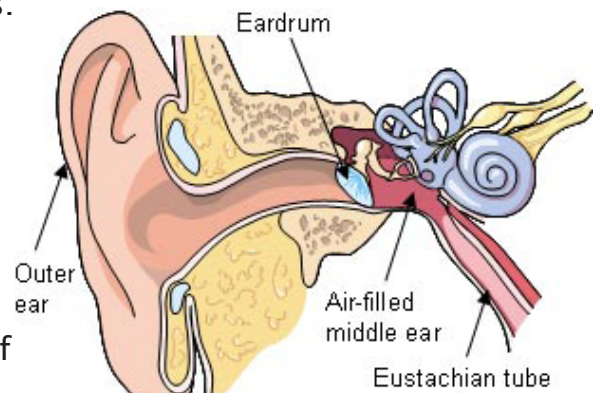
### 1) Common symptoms:

Ear popping, ear clogging for months, ear pain, clicking, "something" closing in the ear, ear fullness, hearing loss, discomfort, ringing, and dizziness.

2) Causes: Multiple causes can result in ETD – for example Allergies, Common Cold, Sinus infections, Middle ear infections (Otitis Media ) with resulting fluid, age related changes with abnormal shape and function especially in infants , reflux, and obstruction in the tube opening. Other causes may include muscular dysfunction, mucosa changes, and autonomic causes. No relationship with any known cause is seen in a large number of adults.

### 3) Variants:

In some patients, the Eustachian tube remains constantly open causing patients to hear their own voice. This condition is called a patulous Eustachian tube and can be distressing. In others, there is a constant clicking noise due to opening and closing of the tube due to rhythmical contraction of muscles in the roof of the mouth. *Continued on page 4.*





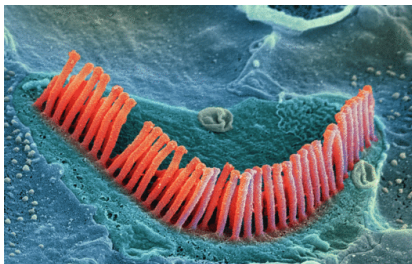
## Living With Tinnitus - Looking For Solutions

By: J.P. Miller, M.S. CCC-A



Forty eight year old Scott Hartquist has been dealing with tinnitus since he was a small boy. He reported that at age 6, a cap gun

exploded near his left ear. His tinnitus began suddenly at that very moment and has never stopped since. He said his tinnitus is a high frequency piercing sound in both ears that he rates an eight on an annoyance scale of ten (ten being the worst and one the least). He further describes the noise as a whistling tea kettle going off in his head every second of every day. Recently he came into our office looking for solutions and telling his story of failed attempts to deal with his debilitating head noises.



Microscopic view of cochlear hair cells

Tinnitus is an involuntary perception of sound that originates in the head. This condition which people often refer to as “ringing in the ear”, affects about 10% of the overall population (McFadden, 1982). Outside of medical conditions that may lead to tinnitus (such as acoustic tumors and noise induced hearing loss), the exact mechanism for this condition is not exactly known. One well respected theory is that damage to the outer hair cells (OHC) in the cochlea (cilia in the inner ear that send signals to the brain) prevents the inhibition

of neural firing of the inner hair cells (IHC). When the OHC can't perform this function, the IHC spontaneously fire neurons to the brain. This neural activity is processed, amplified and recognized as noise, even in the absence of auditory input. This noise is recognized as tinnitus.



Example of a neurostimulation unit by Medtronic.

In 2009, Mr Hartquist participated in a research study conducted by Dr Michael D Seidman of Henry Ford Hospital in Detroit, Michigan. The procedure was called **Cortical Stimulation Treatment for Tinnitus**. It involved opening up the skull and placing electrodes in auditory cortex region of the brain where the tinnitus was perceived. Electrical stimulation was also sent to his frontal lobe area where mood and stress regions are controlled. According to Mr Hartquist, he was actually the first person in the United States receive electrical stimulation to these two areas of the brain. Then the electrodes were connected to a neurostimulator that was placed in the upper chest area. Unfortunately, this procedure did not work for Mr. Hartquist. He remains in contact Dr Seidman.

There are a number of different treatment options for Tinnitus. Mr Hartquist sent the following list that he has researched and added that many of these topics may help a person better cope with their tinnitus.



1. Deep breathing to reduce stress and anxiety;
2. Using a fan or “noise machine” next to the bedside table to create a soothing sleep environment;
3. Avoiding caffeine, alcohol, and other stimulants;
4. Maintain a healthy diet;
5. Acupuncture, herbal remedies, and vitamin supplements;
6. Biofeedback and other relaxation techniques;
7. Drug therapy;
8. Counseling/support groups;
9. Hearing aids;
10. Consistent exercise;
11. Neuromonics devices
12. Tinnitus Retraining Therapy (TRT);
13. Sound or masking therapy.

Mr Hartquist is currently investigating Sound Therapy at our clinic. He is wearing a pair of Resound Live 9 behind the ear digital hearing instruments with slim

tubes in an open ear configuration. These devices have a tinnitus sound generator (TSG) that delivers a broadband noise (can be filtered as well) that can aid in the reduction of the perception of tinnitus. The goal of a TSG device is to decrease the perceived strength of the tinnitus signal by partially masking the tinnitus with the noise generated by the device. Over time it is hope the user will habituate to the tinnitus and learn to put it in the background. Studies have shown this process can take from 3 to 6 months and up to two years for complete habituation to take place. I will continue to monitor Mr Hartquist’s progress with the TSG devices.

At publication time, Mr. Hartquist called me to report he was going for a sleep study. He said that his tinnitus continues to significantly disrupt his sleep. He's hoping the TSG device will give him additional relief from his tinnitus.

McFadden, D. (1982). Tinnitus: facts, theories, and treatments. Report of Working Group 89, Committee on Hearing Bioacoustics and Biomechanics, Washington, DC: National Academy Press.



ReSound Live™TS is a combination digital processor which has both hearing instrument features, as well as a tinnitus sound generator (TSG) feature to help address tinnitus. The TSG can be used in sound therapy to help increase the level of background noise, which can help decrease the contrast of the tinnitus. ReSound Live™TS also contains other unique features, such as frequency shaping of the white noise, amplitude modulation and environmental steering, which can help personalize the TSG and provide more comfort for the individual. It can be fitted with a slim tube for an open ear configuration.



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#### 4) Treatments:

Treatments are directed at the cause. Physicians first conduct a thorough examination and audiometric studies to arrive at the correct diagnosis. In children, we commonly see retracted tympanic membranes and fluid surrounding the ear bones. The cause is normally adenoid obstruction and an immature Eustachian tube. Effective treatment is drainage of the fluid and placement of ventilation tubes for at least a 6 month period. Several children require more than one set of tubes but eventually “grow out” of this condition.

In the adults, ETD is usually accompanied with ear discomfort, fullness or pressure. When a known cause is identified, specific treatments are started for example allergy management. In others, radiological studies and endoscopy may be required to identify a mass or obstruction in the nose. However, the majority of adult patients with ETD go through a series of trials with both nasal sprays and oral allergy medications without any improvement. They have chronic ETD. These patients become very frustrated by these symptoms. Some adults go on to a ventilation tube trial and are helped placement of a long term tube. But, these are the same group of patients who bitterly complain about hearing loss and longstanding tympanic membrane perforation.

#### What's new:

Over the last 20 years, Eustachian tube dysfunction has received renewed attention and ongoing research. The actual function of the system remains unclear. Numerous surgical procedures have been developed to try to correct chronic ETD. These have included placing polyethylene tubes directly into the ET, and surgical approaches to the tube's opening in the pharynx. Recently, Dr. Dennis Poe has performed several laser procedures to help open the tube orifice along with targeted medical management. These treatments have been shown to have positive effects in several patients with chronic ETD.

More recently, balloon dilation of the Eustachian tube (BET) is a viable option for the treatment of patients with chronic ETD. In a recent study on 8 patients with ETD, 13 ET's were dilated with a balloon catheter. All patients had a significant improvement of the ET score comparing pre and 2 month post treatment results. Longer term studies are planned and this relatively simple approach may be one further tool for the treatment of patients with this problem.

Poe, DS., Grimmer, JF., Metson, R. Laser eustachian tuboplasty, two-year results. *Laryngoscope* 2007: 117: 231-7.

Ockermann, T., Reincke, U., Upile, T., Ebmeyer, J., Sudhoff, H. Baloon dilatation Eustachian tuboplasty (BET): a clinical study. *Laryngoscope* 2010:120:1411-6.

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