



Effectiveness of acupuncture for tinnitus

Wong-Kein Low^{1,2}, Wan-Ni Pok¹

¹Novena ENT-Head & Neck Surgery Specialist Centre, Singapore, Singapore; ²Duke-NUS Graduate Medical School, Singapore, Singapore

Correspondence to: Dr. Wong-Kein Low, MBBS, PhD, FRCS, GradDip(Acupuncture). #04-21/22/34, Mount Elizabeth Novena Medical Centre, 38 Irrawaddy Road, Singapore 329563, Singapore. Email: low.wong.kein@gmail.com.

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In the review article “Efficacy of acupuncture for tinnitus: an umbrella review”, the authors presented their findings after analysing six systematic reviews on the topic (1). The studies reviewed were found to be heterogeneous in terms of study design, population characteristics, outcome measures, type of interventions and controls. With the available evidence being limited and conflicting, it was concluded that the effectiveness of acupuncture for tinnitus was still unknown.

The authors recognised that tinnitus had heterogeneity in the underlying pathomechanisms. While acupuncture may be effective in relieving tinnitus caused by a certain pathophysiology, it may not necessarily be an effective treatment for tinnitus caused by a different pathophysiologic mechanism. The authors therefore, recommended further high-quality multicenter randomized controlled trials be conducted on patients whose tinnitus was caused by a specific and well-defined etiology.

Let us explore further to see if there is a specific and well-defined etiology of tinnitus that holds promise in being acupuncture responsive.

With an estimated prevalence of 10–15%, tinnitus is a common symptom with about 20% of adult sufferers requiring clinical intervention (2). For many years, tinnitus was thought to arise almost exclusively from abnormal neuronal activity within the auditory pathways and the resultant compensatory adaptation of the central auditory system. Presumably, this was because tinnitus was common in people with hearing loss.

The commonest cause of hearing loss is due to damage or degeneration of cochlear hair cells. The cochlear consists of both inner and outer hair cells. These cells are inter-linked functionally, facilitated by afferent and efferent

innervations. Hair cell damage or degeneration causes a disruption in the balance of these functional units which can result in tinnitus (3). There have been isolated reports to suggest that acupuncture might have an effect on the activity of the outer hair cells through its efferent nervous system (4).

Besides being generated from the cochlea itself, tinnitus can also arise from the central nervous system (5). In this regard, the dorsal column nuclei (DCN) is thought to play an important role in generating tinnitus. Tinnitus is further complicated by the influence of the brain’s emotional and reactive systems involving negative feedback loops. By working on these feedback systems, habituation can bring about tinnitus relief which is a principle used in Tinnitus Retraining Therapy (6). On this basis, acupuncture may also possibly bring about tinnitus relief

In more recent years however, tinnitus-related neuronal activity is believed to be much more complex and multimodal than a purely neurogenic model. Evidence has been accumulating linking subjective tinnitus to the somatosensory system (7). This relationship may be especially relevant for treatments that are somatosensory in nature, such as acupuncture.

The link between tinnitus and the somatosensory system of the head and neck had been observed for many years. In the well-described Costen syndrome, various otologic symptoms such as tinnitus as well as pain, deafness and ear blockage are related to temporomandibular joint dysfunction. It has been observed that there was increased prevalence of somatoform disorders in individuals with tinnitus (8). There have also been reports of tinnitus occurring after dental pulpitis that resolved after endodontic therapy (9). Tinnitus has been noted

to be associated with upper craniocervical imbalances such as prolapsed intervertebral disc or instability of the craniocervical junction, which resolved following stabilization surgery (10). Tinnitus occurs more frequently in patients who have craniocervical and mandibular disorders such as temporo-mandibular joint dysfunction (11-13).

These observations suggest there are neural connections between the somatosensory and auditory centres. Indeed, it has been shown that the trigeminal and dorsal root ganglia relay afferent somatosensory information from the periphery to secondary sensory neurons in the brainstem, specifically the spinal trigeminal nucleus and DCN respectively (14). Each of these structures was demonstrated to send excitatory projections to the cochlear nucleus. Activation of the trigeminal ganglion elicited excitation in some DCN units and inhibition in others.

Somatic tinnitus is defined as tinnitus where forceful contractions of jaw and neck muscles can modulate the psychoacoustic attributes of tinnitus such as pitch and loudness (14,15). By performing a series of forceful contractions of the relevant jaw and neck muscles that momentarily changed the psychoacoustic attributes of tinnitus, it is possible to identify a subgroup of patients whose tinnitus is somatic in nature (16).

Somatic tinnitus may have been underappreciated as up to 65% of patients have tinnitus that can be modulated by certain somatic maneuvers involving the jaw and head/neck contractions (17). Tinnitus was more likely to be somatically-related if it was unilateral or asymmetric tinnitus in the presence of symmetric pure tone thresholds in both ears (7).

In animal studies, the modulation of firing rate and synchrony in DCN neurons by somatosensory input was shown to be physiologically correlated with somatic tinnitus (14). There has been evidence to suggest that patients with somatic tinnitus respond to somatosensory-based treatment (18). As acupuncture is a modality of somatosensory-based treatment, Levine *et al.* [2007] opined that many of the patients with tinnitus who are responders to acupuncture are in fact, people with somatically induced tinnitus (16).

Therefore, somatic tinnitus may well be the sub-group that holds most promise to be acupuncture responsive. In a small study, Low *et al.* [2017] compared the effectiveness of electro-acupuncture between patients with somatic and non-somatic tinnitus (19). Although a statistical significant difference between the 2 groups could not be demonstrated, the data suggested that the treatment might be more

effective in certain subgroups of patients with somatic tinnitus. Larger randomized controlled trials to further investigate the effectiveness of acupuncture on somatic tinnitus are warranted.

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