

Modulation of tinnitus loudness through pinna lifting and ear canal obstruction

Abstract

Objective: To study the effect on tinnitus loudness on lifting the pinna and obstructing the ear canal.

Study design: Consecutive, prospective case series

Setting: Private practice (secondary referral centre)

Patients: Patients presenting with tinnitus who hear their tinnitus at the time of the examination: 37 patients with mean age 50.8.

Intervention(s): Positioning the index finger in the entrance of the acoustic meatus and pulling the skin on the superior part of the entrance outward and upward, so as to exert a lifting effect on the crus helicis; and obstructing the ear canal with the index finger.

Main outcome measure(s): Subjective evaluation of increase or decrease in tinnitus loudness during the manoeuvre.

Results: On pulling the skin outward tinnitus loudness decreased in 11/37 patients to 61% on average; obstructing the ear canal led to a decrease in tinnitus loudness in 7 patients and an increase in 4 patients.

Conclusions: both lifting the pinna by pulling the skin of the ear canal as well as obstructing the ear canal provoke a change in tinnitus loudness in many patients. The pathway through which these manoeuvres exert their effect is unclear; a somatosensory mechanism or an influence on middle ear acoustics might be involved.

Keywords: tinnitus, somatosensory disorders, ear pinna, ear canal

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Introduction

During clinical examination of patients presenting with tinnitus, we noticed that in some patients tinnitus loudness changed when we lifted the pinna upward and when we obstructed the ear canal with our finger. In most cases the effect lasted as long as the action continued while in some cases it lasted for some seconds to minutes. Some patients reported a change in timbre or pitch. We conducted a small prospective study to better define the occurrence and the extent of the effect produced by both manoeuvres.

Materials/methods

This is a consecutive, prospective case series, conducted in a secondary referral centre and including all patients consulting between November 2011 and April 2012 for any form of tinnitus as primary or secondary complaint. Excluded were only the patients that were not able to hear the tinnitus at that moment, because their tinnitus could only be heard in complete silence, or because it was not present at that precise moment.

37 patients were studied (18 men, 19 women); the mean age was 50.8(22-70). Tinnitus was bilateral in 12 patients, unilateral right in 14 and left in 10, and central in 1 patient. Tinnitus was described as whistling (33 ears), whooshing (13 ears and central in 1 patient), buzzing (1 ear), variable (1 ear).

These patients showed normal tympanic membranes, and none of them suffered from middle ear diseases, Meniere's disease or (to our knowledge) presence of a vestibular schwannoma

This study was approved of by the ethics committee of our institution.

Audiometry showed normal hearing in 6 ears, a flat hearing loss in 6 ears, a high frequency loss in 18 ears, a dip in 11 ears, and a low frequency hearing loss in 5 ears and in both ears of the one patient with central tinnitus. Two patients declined audiometric testing: one fearful patient who suffered from tinnitus and severe hyperacusis, and another one that had been tested extensively elsewhere. Mean tinnitus loudness perception was between 0 and 15 dB SL (mean 4.4 dB SL right, 6.4 dB SL left). Tinnitus pitch, measured with an Interacoustics AC40 audiometer (max frequency 8000 Hz) varied between 125 Hz and 8 KHz.

After completion of the routine clinical examination, the patient was invited to sit down. The examiner, standing behind him/her, asked whether he or she was able to hear the tinnitus. He then placed his index finger in the entrance of the external ear canal, and pulled with his finger the skin of the superior part of the entrance of the ear canal outward and upward. He then asked "does this change your tinnitus? Is it louder, less loud, or unchanged?" Patients who noticed a difference were asked to score the change relative to the original tinnitus loudness, in % more or less, relative to an original score of 100%. The same manoeuvre was then repeated pulling posteriorly, then inferiorly and anteriorly. Every time the same question was repeated. Whenever a patient indicated a change in tinnitus loudness, the manoeuvre and the question were repeated.

The examiner then gently placed his index finger tip in the entrance

of the ear canal of the patient, exerting some pressure so as to close off the ear canal, and repeated the same questions. This manoeuvre was done twice.

The same manoeuvres were carried out on the other ear. In those patients that experienced a change in tinnitus characteristics, both pinnas were then lifted upward, and both ear canals were obstructed. Finally one pinna was lifted upward while the contra lateral ear canal was obstructed, again for both sides. Emergence of a low pitched sound when the ear canal is obstructed is normal and was not counted as positive. In patients presenting with a low frequency tinnitus this was discussed with them so as to make sure that an increase in tinnitus would not be confounded with this physiological sound.

The lifting and obstructing was maintained for as long as necessary for the patient to formulate an answer, i.e. a few seconds for each manoeuvre.

Results

In all, 17 of the 37 patients (45.9%) noted an effect: 6 patients felt an effect only when their pinna was lifted, 6 only when their ear canal was obstructed, and in 5 patients both manoeuvres produced an effect (Table 1). The effect was noticed immediately or within a few seconds after the manoeuvre, and stopped immediately or within a few seconds after halting the manoeuvre.

Table 1 Responders

Age	Sex	Side	Description	Audiogram	pull up R	pull up L	pull up L+R	Obstr R	obstrR	Obstr R+L	pull R obstr L	pull L obstr R
31	M	R	whistling	Normal hearing	Up: 50%							
50	M	L	variable	Flat hearing loss 40 dB	Up: 90%							
53	F	RL	whistling	High frequency loss		50%						
77	M	L	whistling	High frequency loss		90%						
65	F	RL	whooshing	Flat hearing loss (30 dB)		better						
47	F	RL	whistling	Normal hearing with dip R normal with dip	Up: 70%	70%	50%					
52	M	RL	whistling	L high frequency hearing loss	Up: 50%			50%				
44	M	R	whistling	Normal hearing with dip	Up: 30%			50%	50% and duller		30% and duller	100% but duller
77	M	R	whooshing	High frequency loss	Back: 50%		30%	0%				
74	F	R	whooshing	High frequency hearing loss	Up: 90%	50%			50%			
57	M	L	whistling	High frequency loss		50%			0%			
45	F	R	buzzing	Normal hearing				0%				
44	M	L	whistling	Low frequency hearing loss						70%		
44	F	RL	Whistling	-				200%	200%			
27	F	L	whistling	Normal hearing					110%			
50	M	L	whistling	-					150%	180%		
43	F	L	whistling	High frequency hearing loss					200%			

M, male; F, female; R, right ear; L, left ear

Lifting the pinna led to a decrease in tinnitus loudness in 11/37 patients (29.7%); in these patients tinnitus diminished to a mean of 61% (right 56.6%, left 65%). The effect was almost exclusively noted when the pinna was lifted upwards. Only in one patient did pulling backwards diminish a right-sided tinnitus to 50%; in this patient, upward lifting had had no effect. Downward or anterior pulling produced no effect whatsoever. There was an effect on contralateral tinnitus in 2 patients. Bilateral upward lifting produced the same effect as unilateral upward lifting in all but two patients: in these 2 patients the effect of pinna lifting on a unilateral tinnitus became more outspoken when both pinnas were lifted.

Obstructing the ear canal had an effect on tinnitus in 11/37 patients (29.7%): it led to a decrease in tinnitus loudness in 7 patients and an increase in 4 patients. In a particular patient, the effect always went in the same direction: a decrease or increase; for right, left and/or the bilateral manoeuvre. An increase was more often seen in patients that experienced no effect on lifting, although the patient group is too small really to draw any conclusions on that subject. There was an effect on contralateral tinnitus in only 1 patient. Bilateral obstruction produced the same result as unilateral obstruction in all patients but one. The combination of upward lifting right and obstructing left produced an effect in 1 patient only.

Discussion

Subjective tinnitus is a central phenomenon, related to neural plasticity.¹ Several pathways may be involved. Deafferentation, caused by destruction of cochlear hair cells, may cause tinnitus as a phantom sensation.² Somatosensory tinnitus and gaze-evoked tinnitus, thought to be linked to a disinhibition of the ipsilateral dorsal cochlear nucleus (DCN), form a second type of tinnitus. The effect on the dorsal cochlear nucleus is linked to the ipsilateral medullary somatosensory nuclei (MSN), whose neurons receive inputs from the nearby spinal trigeminal tract, fasciculus cuneatus, and facial, vagal, and glossopharyngeal nerve fibres.³ Both types of tinnitus share part of their pathway; indeed the effect of the somatosensory input is more outspoken when deafferentation is present.⁴ Middle ear related tinnitus is a third type of tinnitus frequently observed in patients with ear wax, otosclerosis, otitis media with effusion, tensor tympani syndrome etc., in whom the tinnitus most often disappears at once when the middle ear problem is eliminated. Apart from an obvious link with middle ear acoustics, precious little is known about its pathway. It is not known whether it is related to the other two types. Little is also known of the pathway involved in other forms of tinnitus, such as tinnitus linked to Meniere's disease, in the presence of vestibular schwannomas, perhaps more types of tinnitus may be discerned in the future.

The modulating effect of both manoeuvres may, in our opinion, be connected with the somatosensory and/or middle ear pathway.

For the pinna lifting manoeuvre, a somatosensory mechanism seems rather probable: lifting the pinna and the skin of the ear canal may stimulate stretch receptors in the meatal skin, subcutaneous tissue or cartilage,⁵ and/or proprioceptive receptors in the auricular muscles, more specifically M. Helicis minor and M. Tragicus. In cats, the branches of the cervical plexus (mostly C2) innervating the muscle receptors of the pinna muscles have been found to provide the major spinal source of somatosensory input to the DCN.⁶ In man,

motor innervation of the auricular muscle is provided by the facial nerve; the trigeminal nerve may be involved in proprioception.⁷

A relation to middle ear acoustics, involving a stretching effect on the tympanic membrane, seems far less probable. Such an effect can readily be observed in ears that have been operated upon via a retro-auricular incision. Visually, we have not been able to notice any changes in tympanic membrane tension during a pinna lifting manoeuvre in ears that have not been operated upon.

As for the ear canal occlusion manoeuvre, an influence on somatosensory mechanisms seems rather unlikely. This manoeuvre however does have a major impact on middle ear acoustics, as the ear canal suddenly becomes a closed resonating space: the effect of this manoeuvre on middle ear acoustics is comparable to that produced by some of the conditions that can cause middle ear tinnitus, such as ear wax impaction of the outer part of the ear canal, otitis media with effusion, etc.

Could the effects of both manoeuvres rely on different pathways? It would seem that the decrease effected by lifting and a decrease effected by ear canal obstruction mostly occur in the same patients, but our series is too small to draw any conclusions.

More research studying may show whether these findings remain constant in a particular patient and whether they have any clinical meaning at all.

As is the case for manoeuvres guided at diagnosing somatosensory tinnitus, we do not, at this moment, see any practical consequences for patients who reveal a reduction in tinnitus loudness with these manoeuvres. Future research will perhaps lead to a convenient diagnostic or therapeutic use.

Acknowledgments

None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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