

# Tinnitus

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## Abstract

Chronic idiopathic subjective tinnitus is a common condition affecting around one in ten of the population at any given time. For the majority of people it is an annoyance rather than a major health issue but for approximately 0.5 per cent of the population tinnitus interferes with their ability to pursue a normal life. Modern theories of the pathogenesis of the condition concentrate on the central auditory system although the peripheral auditory system can be a trigger or ignition site for tinnitus. Although a cure remains elusive there are several good treatment strategies based on psychological and neurophysiological models of tinnitus that promote habituation to the symptom.

**Key words:** Ear Diseases; Tinnitus

## Introduction

Defined as ‘the conscious expression of a sound that originates in an involuntary manner in the head of its owner, or may appear to him to do so’<sup>1</sup> tinnitus has been one of the bugbears of humanity for almost as long as medical records have been kept: ancient Babylonian clay tablets from more than 600 years BC contain multiple references to tinnitus together with instructions on how to treat the condition using incantations and charms.<sup>2</sup> Although tinnitus retains its reputation as an enigmatic and troublesome symptom, the last quarter of a century has seen considerable development, not only in our understanding of the mechanisms responsible for the generation of tinnitus but also in our ability to ameliorate the condition. Our knowledge of the epidemiology and natural history of tinnitus has improved and new research methods such as functional magnetic resonance imaging (fMRI) scanning, positron emission tomography (PET) and animal models of tinnitus are helping to unlock many of the secrets. Much work, however, remains to be done.

## Epidemiology

The largest investigation into the epidemiology of tinnitus was carried out as part of a UK, Medical Research Council, Institute of Hearing, longitudinal study of hearing ( $n = 48\,313$ ).<sup>3</sup> This study discovered that the prevalence of persistent spontaneous tinnitus in the adult population was 10.1 per cent, defining persistent spontaneous tinnitus as tinnitus that arose spontaneously, not as response to sound stimulus, and lasted for periods of five or more minutes at a

time. Five per cent described their tinnitus as moderately or severely annoying and 0.5 per cent reported that it had a severe effect on their ability to lead a normal life. Studies in other countries have produced broadly similar figures.<sup>4–6</sup>

A further phase of the Institute of Hearing longitudinal study was carried out in 2002 and the data is currently being analysed. Initial examination has shown that the prevalence of tinnitus in 2002 was almost identical to the 1980 figures (Professor A Davies, personal communication). However, and very interestingly, the people who described tinnitus in 1980 were not the same group that complained of the symptom in 2002. Approximately two thirds of the people who had tinnitus in 1980 did not report it as a problem in 2002, supporting the view that habituation to the symptom is the usual outcome. Tinnitus is common in all age groups but most studies show either an increase in prevalence with age or an increase in tinnitus annoyance with age. Tinnitus is rarely volunteered as a symptom by children and there are methodological difficulties in obtaining reliable prevalence data in this age group. However, the few studies that are available suggest that the prevalence of tinnitus experience in childhood is similar to that in the adult population.<sup>7</sup> The prevalence of tinnitus seems similar in men and women though there are some differences in the way that the sexes perceive the symptom: women are more likely than men to perceive their tinnitus as a complex sound.<sup>8,9</sup> Presence of a hearing loss increases the likelihood of an individual experiencing tinnitus and, in particular, a high frequency hearing deficit is a good predictor of tinnitus. Previous noise exposure is also a good predictor: Davis

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found a prevalence of tinnitus of 7.5 per cent in adults who gave a history of little or no noise exposure but 20.7 per cent in those with high exposure.<sup>10</sup> The relation between tinnitus and hyperacusis has long been recognised and it has been suggested that hyperacusis may be a precursor state for tinnitus. Approximately 40 per cent of patients who present with tinnitus also complain of hyperacusis.<sup>11–13</sup> Of those whose primary complaint is hyperacusis, up to 86 per cent report tinnitus.<sup>14</sup>

### Aetiology

Although the link between high frequency hearing loss and tinnitus might be taken as evidence for a cochlear origin for tinnitus, most modern research underscores the importance of central auditory pathways in both the development and maintenance of distressing tinnitus.<sup>15–17</sup> Tinnitus can exist in the presence of a perfectly functioning auditory periphery. Conversely, it can exist even if the auditory periphery has been completely destroyed or after the neural connections between ear and brain have been severed, as can be seen following some forms of vestibular schwannoma surgery.<sup>18</sup> In addition, damage to the auditory system does not automatically induce tinnitus: although noise induced hearing loss increases the likelihood of someone reporting tinnitus, the majority of people with cochlear damage secondary to noise exposure do not have significant tinnitus. Recently these observations have been drawn together in a concept that makes a distinction between the location, within either the peripheral or central auditory system, at which an initial tinnitus signal is generated and the subsequent central auditory mechanism by which this signal is misconstrued as a sound with the potential to become a clinical problem. The point at which the initial signal generation occurs has been dubbed the *ignition site* and the ensuing central mechanisms have been entitled *promotion*.<sup>19,20</sup> Pathological events which create an ignition site do not inevitably generate tinnitus – the central promotion must also be present. This theory has clinical relevance in that if tinnitus distress is maintained by central auditory pathways it may be futile trying to correct peripheral auditory pathology.

Recently it has become apparent that tinnitus can be influenced by stimuli from without the auditory system: many patients with tinnitus can modulate their symptom by touching their face<sup>21,22</sup> or clenching their teeth.<sup>23</sup> Although this was initially dismissed as a rare curio it has become apparent that this phenomenon is quite common, highlighting the importance of links between the auditory system and other somatosensory pathways.

Tinnitus is commonly subjective and is not discernable to anyone apart from the patient. A few forms of tinnitus such as some cases of pulsatile tinnitus<sup>24</sup> or the tinnitus due to myoclonus of the palatal muscles<sup>25</sup> may be detectable by others and are categorized as objective tinnitus. Other cases of tinnitus are associated with specific disease processes such as otosclerosis, Ménière's disease or vestibular

schwannoma and are classified as syndromic tinnitus. Objective and syndromic tinnitus will not be considered in detail in this review.

### Treatment

While there is still no curative procedure or medication for the majority of patients with tinnitus there are many therapeutic options that claim to help alleviate the condition. There are problems associated with evaluating these treatments: many of the methods used do not lend themselves to the strictures of evidence-based medicine and may be impossible to blind. Devising control groups for some tinnitus interventions is difficult. Patients in trials often respond well to the placebo arm of the trial. In one study 40 per cent of patients reported change in their tinnitus following placebo injection.<sup>26</sup> This is often regarded rather pejoratively by practitioners of modern medicine, overlooking the fact that a placebo effect is not the same as no effect.<sup>27</sup>

### Explanation and reassurance

A thirst for more knowledge about their condition is almost universal among tinnitus patients. It is surprising, therefore, how little research has been done on this topic. In 1991 Loumidis *et al.*<sup>28</sup> investigated the effect of giving written information to tinnitus patients. They found that this made no difference to tinnitus distress but did seem to make the patients more self reliant: patients who received written information were less likely to want professional help. Information technology has altered enormously in the years since this study and nowadays many patients have already done quite detailed research on tinnitus before they seek medical advice, often using information available on the internet. Unfortunately the quality of this information is extremely variable and one simple thing that medical staff can do is to give patients details of the reliable websites. Charities such as the British Tinnitus Association and the Royal National Institute for the Deaf (RNID) (see Appendix I) have clear and informative websites. Both these charities also have telephone helplines for patients with tinnitus and produce an extensive range of advice leaflets for those without internet access. There are self help groups in many parts of the country: details of these are available from the British Tinnitus Association. Delivery of specialist tinnitus services throughout the UK is very variable. Tinnitus has recently been taken under the umbrella of the 'Do Once And Share' programme (DOAS) and hopefully this should help to even out some of the inequalities.

A common report of patients seen in specialist tinnitus clinics is that clinicians who they have previously consulted have offered a very pessimistic view of tinnitus outcome. Reports such as 'the doctor told me that I would have it forever and nothing can be done' are all too common. This negative counselling is damaging for patients with tinnitus<sup>29</sup> and should always be avoided.

### *Habituation based therapies*

Most strategies currently used in mainstream western medicine for managing tinnitus are based on either the psychological or the neurophysiological models. In 1984 Hallam *et al.*<sup>30</sup> suggested that tinnitus was caused by 'some neurophysiological disturbance in the auditory system at any point between periphery and cortex'. They went on to suggest that normally the central auditory system should habituate to this activity. However, in certain situations such as high autonomic arousal this process does not happen and the tinnitus activity can become intrusive. Treatment modalities that arose from this concept included the use of relaxation therapy to reduce autonomic activity and cognitive behavioural therapy<sup>31</sup> to help change the emotional significance of the tinnitus. In 1990 Jastreboff published a 'neurophysiological model' of tinnitus,<sup>32</sup> drawing together all the available knowledge at the time and suggesting that in addition to events within the classical auditory system, tinnitus involved altered activity within the limbic system, reticular system and autonomic nervous system. This model was then used to produce a clinical application called 'tinnitus retraining therapy'.<sup>33,34</sup> Tinnitus retraining therapy consists of counselling and sound therapy following quite a rigorous protocol. However, the neurophysiological model can be interpreted differently and many tinnitus practitioners apply the clinical extrapolates of the model in a less rigorous fashion. There is a dearth of solid scientific backing for both cognitive behavioural therapy and tinnitus retraining therapy in the management of tinnitus but at least some of this paucity represents the difficulty of performing research in a field where treatments are based on such factors as the interaction between practitioner and patient or the use of sound therapy. Thus much of the available research has used flawed methodology such as waiting list control groups or observational studies. Nonetheless, the studies that are available suggest that both approaches are helpful<sup>35-37</sup> although patients not infrequently criticize them as teaching coping strategies rather than offering a cure. The use of psychological techniques such as cognitive behavioural therapy in the United Kingdom is hugely hampered by a lack of psychologists with appropriate tinnitus training. A Swedish group has investigated delivering cognitive behavioural therapy via the internet and initial results suggest that this may be a useful approach.<sup>38</sup>

### *Sound therapies*

Sound therapy can be used as part of tinnitus retraining therapy or as a stand-alone treatment. It is possible to use sound to completely suppress, or mask, tinnitus in 95 per cent of tinnitus patients in a clinic setting using specialist equipment,<sup>39</sup> with 92 per cent experiencing complete masking. Translating this into practical treatment is less successful. Also, it has been suggested that complete masking is counterproductive as it may prevent habituation to the tinnitus signal. Proponents of tinnitus retraining therapy suggest that sound therapy is important but

not used as masking. Instead it is advocated that sound should be used at very low levels at a point where the added sound is just below the perceived level of the tinnitus.<sup>40</sup> Sound therapy at this so-called mixing or blending point is supposed to facilitate the habituation process although there is conflicting evidence to the efficacy of this approach.<sup>41,42</sup> There are three methods of providing wearable sound therapy: patients may wear hearing aids that produce masking by amplifying ambient sound, small ear level devices that generate wide band sound (known as tinnitus maskers, sound generators, white noise generators or wide band sound generators) or combination devices that blend the functions of the first two types of device. Whether such devices deliver masking or sound therapy at mixing point simply reflects the output level that is set on the device. In the situation where a tinnitus patient has a hearing loss in addition to their tinnitus there is some evidence that addressing the hearing deficit helps the tinnitus. Such patients should be encouraged to try appropriate hearing aids even if they feel that amplification is not yet required for the hearing loss. An alternative to donning a wearable device is to use an appliance that produces sound in the patient's immediate environment. This can include devices such as wind chimes and water features, pre-recorded compact discs and electronic environmental sound generators. Sound from the latter two devices can be fed to a loudspeaker fitted into or under a pillow, allowing the patient to hear the sound while preparing for sleep without impinging on his/her partner.

Ultrasound has also been used to treat tinnitus: high-frequency sound is applied by a bone conduction transducer. The rationale of this approach is that the ultrasound should stimulate the cochlea without interfering with the patient's hearing for sounds occurring in the normal auditory spectrum. An initial study reported optimistic results<sup>43</sup> but this was not repeated.<sup>44</sup>

### *Other tinnitus devices and physical treatments*

Lasers have successfully been used in the management of some forms of chronic pain but the exact mechanism for this benefit remains contentious. Low power lasers have been used in the treatment of tinnitus, applied either transmeatally or to the mastoid process. Although some workers have reported good results from such treatment,<sup>45,46</sup> two well constructed trials have found no benefit above that derived from placebo.<sup>47,48</sup>

Vibration therapy has been suggested as a possible tinnitus therapy with the rationale that mechanical vibrations applied to the scalp could reduce tinnitus by stimulation of the cochlea. Although such devices are currently available on the market there is no evidence to support their use.

Direct electrical stimulation of the ear has been shown to suppress tinnitus<sup>49</sup> but delivering this stimulation is invasive and risks damage to the inner ear. Partly because of this tantalising glimpse of a tinnitus suppressant, other ways of delivering electrical and

magnetic energy to the cochlea or central auditory system have been investigated. High powered rare earth magnets have been placed in the ear canal but despite initial positive reports a randomized controlled trial failed to show any benefit.<sup>50</sup> Electromagnetism has also been investigated: initial trials gave mixed results.<sup>51</sup> More recently electromagnetism has been used in conjunction with functional imaging such as PET scanning or fMRI: pathologically active areas of brain are identified and electromagnetic therapy is then directed to this area.<sup>52–53</sup> This technique of transcranial magnetic stimulation is very much in its infancy and long-term studies with adequate numbers of patients are awaited.

### *Surgery*

Surgery has a definite role in the management of tinnitus associated with certain conditions such as otosclerosis when stapedectomy is reported as improving or eradicating tinnitus in 80 per cent<sup>54</sup> to 88.3 per cent.<sup>55</sup> Surgery is also important in the management of pulsatile tinnitus.<sup>24</sup> However, the role of surgery in the treatment of chronic idiopathic tinnitus is much less encouraging. Such treatments include decompressive and destructive treatments. Modern imaging techniques and in particular MRI have shown that vascular loops are common in proximity to the cochlear nerves of patients with tinnitus. There have been suggestions that laterally placed loops generate pulsatile tinnitus whereas vessels adjacent to the medial half of the nerve generate non-pulsatile tinnitus.<sup>56</sup> However, the prevalence of such loops in people who do not have tinnitus is unknown. Microvascular decompression of vascular loops in tinnitus patients has been used with very variable results ranging from 40 per cent improvement<sup>57</sup> to 77 per cent.<sup>58</sup> The highly invasive nature of this surgery precludes its use in all but the most exceptional cases. Destructive surgical procedures including VIIIth nerve neurectomy or selective cochlear neurectomy have been tried but there is no trial using validated outcome measures.

Tinnitus may be associated with profound hearing loss and in this group of patients tinnitus suppression has been demonstrated as a secondary benefit of cochlear implantation. Improvement of tinnitus occurs in up to 86 per cent of implanted patients and interestingly in up to 67 per cent the benefit applies to the contralateral ear as well as the implanted ear.<sup>59</sup> There is no good evidence to support cochlear implantation for the sole purpose of tinnitus suppression and it would be ethically difficult to propose cochlear implantation for someone with significant residual hearing.

### *Drugs*

Although drug therapy should be relatively easy to investigate, much of the published information is of poor quality. Use of inert placebos, inadequate outcome measures and high drop-out rates are common in drug trials. Moreover, most trials have failed to make a distinction between helping concomitant psychological illness and direct effect

on tinnitus. Tinnitus drug trials are often carried out on small groups of patients and consequently lack the power to detect small effects.

Psychoactive drugs have been used in the management of tinnitus partly because tinnitus patients score highly for symptoms of psychological distress<sup>60</sup> and partly because many of the receptors that psychoactive drugs act upon are also found within central auditory pathways. While there is a role for such drugs in the treatment of any psychological or psychiatric disease that accompanies tinnitus the situation with respect to the tinnitus itself is less clear. There are four reasonably constructed randomized controlled trials which investigated the use of tricyclic antidepressant drugs.<sup>61–64</sup> These all reported slight improvement in tinnitus but these conclusions may be attributable to methodological flaws and no major conclusion can be drawn. A well constructed trial of a selective serotonin reuptake inhibitor, paroxetine, showed no advantage over placebo for the majority of criteria investigated.<sup>65</sup> Benzodiazepines have been widely used in the management of tinnitus and some work has suggested that this group of drugs may have a direct effect on tinnitus.<sup>66</sup> Unfortunately, this research can be criticized for using an inert placebo and in any case the propensity for benzodiazepines to induce dependence restricts their usage.

Antiepileptic<sup>67–68</sup> and antispasmodic<sup>69</sup> drugs have both been investigated for potential activity against tinnitus but the results have been disappointing. Likewise the use of vasodilators<sup>70</sup> and diuretics<sup>71</sup> has proved unhelpful. Betahistine is frequently administered to patients with idiopathic tinnitus: there is no scientific rationale for this action.

Local anaesthetic agents have offered one glimmer of hope for a possible pharmacological solution to tinnitus. Following a serendipitous discovery when procaine caused temporary abatement of tinnitus in a patient undergoing nasal surgery,<sup>72</sup> several trials have confirmed that intravenous injections of amide local anaesthetic agents cause short-term reduction of tinnitus. A recent double-blind, placebo-controlled, crossover trial investigated 16 patients who had post-operative tinnitus following translabyrinthine resection of a vestibular schwannoma.<sup>73</sup> Bolus intravenous injection of lidocaine produced significant short-term tinnitus suppression despite the fact that the VIIIth nerve had been divided during the surgical procedure. Although the trial can be criticized for using an inert placebo, the observations suggest that, at least within this group, the anti tinnitus effect of the local anaesthetic agent was central rather than peripheral. Previous attempts to find a less hazardous and orally active agent that has the same beneficial effects as these local anaesthetics have failed.<sup>74</sup> Following this trial this subject is being re-investigated.

Recently botulinum toxin has been shown to be beneficial through nonparalytic effects for conditions such as neuropathic pain and migraine. With respect to migraine, botulinum toxin is thought to block not only acetylcholine, but also to inhibit the release of other neurotransmitters and neuropeptides involved in the autonomic pathway. Botulinum toxin A has

been trialled in a small study of 26 tinnitus patients.<sup>75</sup> Benefit was demonstrated in the treatment arm as compared to the control arm, but due to the small number of patients recruited, no statistical significance was demonstrated.

Two small-scale trials have shown that the hormone melatonin helps patients who have sleep disorders associated with tinnitus.<sup>76,77</sup> As many patients with tinnitus do have sleep disorders<sup>78</sup> this merits further investigation.

Tinnitus, like idiopathic sudden sensorineural hearing loss, has been thought to arise from a lack of oxygen secondary to vascular insufficiency. For this reason interest has been shown in the application of hyperbaric oxygen therapy to increase the supply of oxygen to the ear and brain to reduce the severity of hearing loss and tinnitus. A critical assessment of the role of hyperbaric oxygen therapy has been performed by way of a Cochrane review<sup>79</sup> and no clear value could be demonstrated.

Following the successful experience of using transtympanic administration of aminoglycosides in the treatment of Ménière's disease, transtympanic administration of therapeutic substances has been trialled in subjective idiopathic tinnitus. It has been theorized that this allows direct labyrinthine drug absorption which may offer improved labyrinthine metabolism and hence reduction of tinnitus in those patients who have tinnitus in association with cochlear pathology. Various agents, including steroids,<sup>80</sup> local anaesthetic agents,<sup>81</sup> anticholinergic drugs,<sup>82</sup> glutamate antagonists<sup>83</sup> and antioxidant compounds<sup>83</sup> have been delivered into the middle ear, either by single transtympanic injections, through perforations and grommets, or via an implanted micropump.<sup>84</sup> Most of the trials in this area are small observational studies. The solitary placebo-controlled trial in this field demonstrated no advantage of intratympanic dexamethasone over placebo.<sup>85</sup>

#### Dietary supplements

A large number of vitamins, minerals and other dietary supplements have been given to tinnitus patients in an effort to alleviate the condition. Some of the agents used are listed in Table I although this is far from an exhaustive list. There is some evidence that some of these compounds, particularly the B vitamins can help to defend the cochlea against noise trauma.<sup>86</sup> However, there is no convincing evidence that they have any effect against established idiopathic tinnitus. The human cochlea has the body's greatest concentration of zinc. Some studies have demonstrated a significant decrease in zinc levels in patients suffering from tinnitus and rectifying this deficiency has been shown to significantly decrease tinnitus.<sup>87</sup> Paaske *et al.*,<sup>88</sup> however, demonstrated little correlation between hypozincaemia and tinnitus, and no significant improvement in tinnitus with zinc supplementation.

#### Complementary or alternative therapies

Many forms of complementary medicine are promoted as being beneficial for tinnitus patients.

TABLE I

SOME OF THE DIETARY SUPPLEMENTS THAT HAVE BEEN USED IN THE MANAGEMENT OF TINNITUS

Supplement	Class of supplement
Arginine	Amino Acid
Beta Carotene	Antioxidant and vitamin precursor
Calcium	Mineral
Folic Acid	Vitamin
Ipriflavone	Bioflavonoid
Magnesium	Mineral
Manganese	Mineral
N-Acetylcysteine (NAC)	Antioxidant
Omega-3	Fish Oil
Potassium	Mineral
Selenium	Mineral
Vitamin A	Vitamin
Vitamin B1 (Thiamine)	Vitamin
Vitamin B3 (Niacin)	Vitamin
Vitamin B6 (Pyridoxine)	Vitamin
Vitamin B12	Vitamin
Vitamin C	Vitamin
Vitamin E	Vitamin
Zinc	Mineral

A list of some of the more commonly used modalities is shown in Table II. Many of these therapies involve much contact between the therapist and patient and promote a sense of relaxation. It might therefore be expected that these therapies could help tinnitus patients, at least in a non-specific way. There is little, if any, evidence that any of these treatments have any specific activity against tinnitus.

Ginkgo biloba has attracted more interest for the treatment of tinnitus than any other complementary therapy. The efficacy of ginkgo has had mixed support. A number of large double-blinded placebo-controlled trials have been undertaken reaching different conclusions. In 2001 Drew and Davies<sup>89</sup> failed to demonstrate a significant effect in treating

TABLE II

SOME OF THE COMPLEMENTARY MEDICINE THERAPIES AND EXERCISE REGIMES THAT HAVE BEEN USED IN THE MANAGEMENT OF TINNITUS

Therapy
Acupuncture
Alexander technique
Aromatherapy
Chiropractic
Craniosacral therapy
Herbal medicine
Black cohosh
Ginkgo biloba
St. John's Wort
Homeopathy
Hopi ear candles
Hypnotherapy
Massage
Meditation
Osteopathy
Reflexology
Reiki
Shiatsu
Tai Chi
Yoga

tinnitus using ginkgo doses of 150 mg. A double-blinded placebo-controlled trial and meta-analysis of randomized trials recently concluded that ginkgo did not benefit patients with tinnitus.<sup>90</sup> Despite these reports it must be noted that the success of other studies have been based on much higher doses of up to a daily total of 480 mg of ginkgo extract.<sup>91</sup> Further supporting the role of ginkgo is a controlled study demonstrating a statistically significant reduction in tinnitus using an animal model.<sup>92</sup> Systematic appraisal of the role of ginkgo has been performed by way of a Cochrane review<sup>93</sup> which found no reliable evidence supporting its use as many of the studies performed have been flawed in one way or another.

In 2000 Park and colleagues<sup>94</sup> systematically reviewed the efficacy of acupuncture as a treatment for tinnitus. This review identified only six randomized trials; two unblinded trials and four blinded trials. The two unblinded trials demonstrated a positive effect of acupuncture treatment for tinnitus, whereas the four patient-blinded, sham-controlled studies demonstrated no significant difference between treatment with acupuncture and placebo.

There have been some claims that chiropractic manipulation benefits tinnitus sufferers, however there have been no scientific studies to substantiate any positive effect in comparison to placebo.

A note of caution must be sounded regarding the use of Hopi ear candles in the management of tinnitus. Not only has no benefit been demonstrated but in a few instances damage to the ear has resulted as a consequence of their usage.<sup>95</sup>

Several exercise regimes such as Tai Chi and yoga have been promoted as helping patients with tinnitus. In these cases, no claim is made that the exercises treat the tinnitus directly but rather that the techniques promote relaxation and combat stress.

## Conclusion

Although there are difficulties in performing rigorous scientific research into tinnitus, our knowledge about the condition is slowly but definitely improving. Theories of pathogenesis have moved away from a purely cochlear model and are now stressing the importance of the entire auditory system and particularly the central auditory system. Better understanding of the natural history of the condition suggests that tinnitus is a self limiting condition in most cases. Mainstream treatment modalities based on psychological and neurophysiological models of tinnitus are aimed at promoting habituation to the symptom. Many other treatments have been tried both within the field of conventional medicine and complementary medicine. When subjected to scientific scrutiny most of these therapies supply no benefit beyond a placebo effect.

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## APPENDIX I

### RESOURCES

The British Tinnitus Association,  
Ground Floor, Unit 5,  
Acorn Business Park, Woodseats Close,  
Sheffield, S8 0TB, UK.  
Telephone: 0800 018 0527 free of charge (from within the UK, supplied by MCI Worldcom)  
0845 4500 321 local rate (from within the UK only)  
0114 250 9922 national rate within the UK  
+ 44 (0)114 250 9922 outside the UK  
Fax: 0114 258 2279 from within the UK  
+ 44 (0)114 258 2279 outside the UK  
Website: [www.tinnitus.org.uk](http://www.tinnitus.org.uk)

### RNID

19–23 Featherstone Street,  
London,  
EC1Y 8SL, UK.  
Telephone: 0808 808 0123 (freephone)  
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