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Bhramari Pranayama and Alternative Treatments of Tinnitus: In Pursuit of the Cure

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1. Introduction

TINNITUS - a symptom which can have a range of adverse effects for a significant number of people with the result of detrimental impacts on their quality of life. However, tinnitus remains poorly understood and there is no uniformly effective therapy.

This chapter is intended to introduce a novel approach to the management of tinnitus using Bhramari Pranayama (BP). Minimal information on alternative clinical management is provided. The chapter addresses treatment options for patients with tinnitus including pharmachological treatment, surgery, electrical stimulation, transcranial magnetic stimulation, masking therapy, hearing aids, ultra high frequency vibration therapy, Neuromonics tinnitus treatment, sound stimulation therapy during sleep, tinnitus retraining therapy, cognitive behavioural therapy, virtual reality therapy, biofeedback therapy, neurofeedback therapy, as well as research leading to tinnitus management and recommendations for future research.

Although there is no cure for tinnitus, research from around the world probes tinnitus's potential therapies. The intensive work in applying the principles of Bhramari Pranayama is explaining successful tinnitus management (Pandey et al., 2010). The primary goal of this chapter is to provide a therapeutic approach (Bhramari Pranayama) for tinnitus sufferers by helping them overcome the loudness of tinnitus, the psychosocial (inability to participate in leisure activity and work, difficulty in concentration, depression) and also the physical (sleep disturbance, muscle tension) consequences of tinnitus. It is important to note that Bhramari Pranayama can be used in patients with a high degree of severity of tinnitus whereas other therapeutic approaches like masking therapy or sound therapy may not be appropriate in the same conditions. The application of the Bhramari Pranayama concept helps the sufferer to design and implement a program to manage their tinnitus and associated difficulties. The concepts of the limbic system and neural plasticity are also addressed, taking into consideration their association with Bhramari Pranayama.

There are three main components of tinnitus which interact with and influence each other. The first being the *acoustic* component, which is perceived most commonly as an undesirable continuous, high pitched ringing sound. The second aspect of tinnitus is the *attentional* component, and this refers to the degree to which the afflicted person listens to or

focuses on the tinnitus. The patient often finds it difficult to concentrate on anything else. The third aspect is the *emotional* component, which is an affective reaction to the tinnitus. This component generally determines the severity of a person's response to tinnitus. There is a hierarchy of reactions ranging from frustration or annoyance in milder cases, to anxiety or depression in more severe cases (Kaltenbach, 2009).

In the mid-1990s, researchers began a series of studies using imaging techniques that have helped change our understanding of the mechanics of tinnitus and potential treatment options for it. There have been two reports about the perception of tinnitus which have been carried out by using imaging techniques. The first study used single photon emission computerized tomography (SPECT), which identified the temporal, frontal and parietal lobes, as well as the amygdala and hippocampus as playing roles in tinnitus perception (Shulman et al., 1995). The second study with positron emission tomography (PET) identified the temporal, parietal areas and subcortical structures (Mirz et al., 1999). Previously, it was generally believed that the tinnitus originated in the ear.

Three zones have been identified where tinnitus is perceived. The prefrontal area in relation to attention and stress, the primary temporal area in relation to hearing and related emotive association with the parietal area, and the limbic system that is composed of different subcortical structures that control emotions, learning, memory and motivated behavior (Lopez-Gonzalez & Esteban-Ortega, 2005).

Evidence from human brain imaging studies confirms the involvement of central structures in tinnitus and points to changes not only in the auditory cortex (Giraud et al., 1999; Lockwood et al., 2001) but also in limbic structures associated with emotion (Lockwood et al., 2001). A recent study described structural alterations in the central nervous system that were detected in tinnitus patients using voxel-based morphometry (VBM); it was found that significant decreases of grey matter in the right inferior colliculus and in the left hippocampus confirmed the important role of the limbic system in the pathophysiology of tinnitus (Landgrebe et al., 2009).

2. Treatment of tinnitus

Even with recent medical advances, no therapy has been found to be uniformly effective in the treatment of tinnitus. However, certain forms of therapy are well defined and are used routinely to treat tinnitus.

2.1 Pharmacological treatment

Various pharmacological therapies have been studied in the treatment of tinnitus. Unfortunately, most studies evaluating the efficacy of these drugs have demonstrated variable success. Currently, no pharmacological agent is specifically administered for tinnitus (Patterson & Balough, 2006). The use of drugs should be considered for tinnitus patients only when sleep disorders, depression, and/or anxiety are reported as significant coexisting conditions (Dobie, 1999). The rationale behind the use of these agents for the treatment of tinnitus should not be overlooked. A consistent approach to studying pharmacological agents in tinnitus is needed.

The use of alternative medication such as magnesium, zinc, melatonin, lidocaine, botulinum toxins, antioxidant minerals, B vitamins, Ginkgo biloba and other herbal remedies have reduced the severity of tinnitus in some sufferers (Fornaro & Martino, 2010).

2.1.1 Ginkgo biloba

Ginkgo biloba extract is a powerful glutamate antagonist which acts as a strong antioxidant within the cochlea, helping to minimize the damage caused by free radical build-up. EGB761 is the most common isolate of Ginkgo biloba which increases body circulation and has benefits for vascular insufficiency and cognitive function (Seidman & Babu, 2003). Improvement in blood circulation to the organ of Corti has been suggested as a mechanism for ameliorating tinnitus (Holgers et al., 1994; Patterson & Balough, 2006). In a rodent model, EGB761 resulted in a statistically significant decrease in the behavioral manifestation of tinnitus induced by sodium salicylate toxicity even at minimal doses (Jastreboff et al., 1997). Some reports indicated that Ginkgo biloba, one of the most ancient medicinal plants, provided significant improvement for tinnitus patients (Coles, 1988). Other contradictory studies have not identified any effect for tinnitus (Ernst & Stevinson, 1999; Drew & Davies, 2001). Holstein (2001) reported that short-standing disorders have a better prognosis and better results can be expected from early-onset treatment. Recent reports showed that Ginkgo biloba extract alone or combined with Bhramari Pranayama have positive effects on tinnitus (Pandey et al., 2010).

2.2 Surgery

Traditional medical approaches to the treatment of tinnitus have included surgical procedures. Surgery may be performed in order to attend to an underlying process or disease which may ultimately influence the tinnitus or more directly, for the specific purpose of tinnitus relief. Surgical treatment of tinnitus includes destructive procedures such as neurectomies, stapedectomies and tympanosympathectomies. Translabyrinthine procedures for the removal of acoustic neuromas and sectioning of the eighth nerve to eliminate vertigo are analogous to cutting the eighth nerve as a surgical intervention for tinnitus (House & Brackmann, 1981).

2.3 Electrical stimulation

A Berlin physician, Dr C. J. C. Grapengeiss (1801) reported on the use of electrical current in suppressing tinnitus. Since then rigorous efforts have been made to evaluate the same treatment. The use of electrical stimulation for the relief of tinnitus has demonstrated some positive findings. However, there is some indication that it may produce damage to the neural tissue particularly with the use of direct current (Hazell et al., 1989; Staller, 1998). Alternating current does not cause these damaging effects but its effectiveness is limited to very few patients. Electrical stimulation is not a method that is presently useful in clinical practice to treat tinnitus but is considered a promising area of investigation. (Dauman, 2000; Rubinstein & Tyler, 2004). Recently, cochlear implants were found to be effective for reducing the sensation of tinnitus (Vernon, 2000; Ruckenstein et al., 2001). Tinnitus is usually masked in patients with cochlear implants. The reorganization of the central auditory nervous system after restoration of peripheral sensory input may have positive effects on tinnitus improvement (Moller, 2003; Del Bo & Ambrosetti, 2007). Cochlear implants have also been observed to exacerbate tinnitus (Tyler, 1995). Cortical electric stimulation of the auditory cortex for treatment of tinnitus is still at the research level (De Ridder et al., 2007a).

2.4 Transcranial magnetic stimulation

Recently it has been shown that stimulation of specific regions of the human brain can alter (suppress) tinnitus in some patients (De Ridder et al., 2004; De Ridder et al., 2006). Auditory

cortex stimulation can be performed with a strong impulse of magnetic field that induces an electrical current in the brain (transcranial magnetic stimulation) or with implanted electrodes (De Ridder et al., 2004; De Ridder et al., 2006). There have been a number of recent reports about the possible therapeutic effects of repetitive transcranial magnetic stimulation (rTMS) for the treatment of tinnitus.

Burst rTMS (Repetitive transcranial magnetic stimulation) is capable of suppressing narrowband/white noise tinnitus much better than tonic rTMS (De Ridder et al., 2007b). Burst firing is a more powerful activator of the cerebral cortex than tonic firing (Lisman 1997; Swadlow and Gusev, 2001; Sherman, 2001). This may be related to the fact that burst activation requires less temporal integration to reach the threshold of a neuron and bursts may activate neurons that are not activated by tonic stimulations, unmasking dormant synapses (Moller, 2006).

Mixed findings have been reported when considering the efficacy of rTMS. The results of some studies suggest that rTMS might be a useful treatment for tinnitus (Kleinjung et al., 2008; Khedr et al., 2008; Lopez-Ibor et al., 2008). Lee et al., 2008 did not report statistically significant improvements.

In spite of the many advances in medical science, progress in treatment of tinnitus has been tardy. Thus far, tinnitus remains a condition which is mainly refractory to conventional medical approaches. The uses of medication, electrical suppression, cochlear implants or surgical procedures are potential medical treatments of any underlying aetiological conditions.

Regardless of the form of treatment, sound is used in one way or another to distract attention from the tinnitus and to reduce the brain's perceived need for stimulation (Henry et al., 2002). Traditionally, three general types of treatments have been most commonly used: masking, hearing aids, and sound therapy in combination with counseling. Acoustic therapy involves using an external sound to reduce or eliminate the perception of tinnitus (Folmer & Carroll, 2006; Vernon & Meikle, 2000) or modify the individuals' emotional reaction to it (Davis, 2006). Sound stimulation may also reverse or alter the abnormal cortical reorganisation thought to be responsible for tinnitus (Norena et al., 2008).

2.5 Masking therapy

A Parisian physician, Jean Marie Gaspard Itard, advocated the use of masking in 1801. Masking by various noises was methodically applied as a remedy for tinnitus in 1821 by Itard. In 1883, Urbantschitsch extensively studied masking of tinnitus by pure tones, such as tuning forks. Jones & Knudsen (1928) created the first electrical masking device (Henry, 1992). Masking devices were introduced on the principle of distraction, that is, if a level of noise, usually 'white noise', is introduced, it can reduce the contrast between the tinnitus signal and background activity in the auditory system, causing a decrease in the patient's perception of their tinnitus (Vernon, 1977).

It is important not to confuse the term 'masking', as used in tinnitus masking, with the masking used in audiological testing. In audiometry, masking occurs largely at the level of the cochlea due to interaction of travelling waves of the stimulus and masker (Searchfield et al., 2010). Tinnitus is a neural representation of a sound, not a physical sound wave, and as such masking cannot occur at the level of the cochlea. Instead, tinnitus masking must occur through another central mechanism. This conclusion is supported by many studies showing that masking of tinnitus does not behave like the masking of an external sound (Vernon & Meikle, 2000). In conventional masking, a pure tone cannot successfully mask a broadband

sound, but, in tinnitus masking, some studies have found that presentation of a pure tone can mask tinnitus that is perceived as a broadband sound (Vernon & Meikle, 2000; Searchfield et al., 2010).

A variety of masking stimuli have been used for tinnitus relief. The use of a narrowband noise centered around the perceived pitch of the tinnitus is an attempt to provide relief by either completely or partially obscuring the patient's perception of the tinnitus (Vernon, 1977). Narrowband noise was once considered the most common form of acoustic tinnitus management. There are other stimuli now being increasingly recommended (Sweetow & Sabes, 2010). Henry et al. (2004) & Hann et al. (2008) found dynamic sounds, such as music and rain, to be more effective as maskers compared to narrowband and broadband noise.

The complete masking approach used initially, incorporated the increase of intensity or volume to a level where the tinnitus became imperceptible (Coles, 1997). Later research indicated that using low levels of white noise which was barely audible was more effective in achieving adaptation or down regulation (habituation of disordered auditory perception) (Mckinney et al., 1995; Jasterboff, 1995).

2.6 Hearing aids

Hearing aids have been long recognized to reduce the bothersome effects of tinnitus (Saltzman & Ersner, 1947; Surr et al., 1985; Melin et al., 1987). Amplified external sounds or the internal noise of hearing aids could mask the tinnitus (Tyler & Bentler, 1987). Many tinnitus patients with hearing loss have benefited from a hearing aid. Hearing aids help in their hearing disability and also reduce the severity of their tinnitus.

The exact mechanisms underlying the beneficial effects of amplification are uncertain, but it may be that tinnitus is exacerbated by silence, as the brain then seeks out the neural stimulation it is being deprived of by the hearing loss. Amplification increases neural activity and may thus assist in "turning down" the brain's sensitivity control. Another apparent factor is that hearing aids amplify background noise sufficiently to partially mask the tinnitus, or at least reduce its contrast to silence (Sweetow & Henderson, 2010).

2.7 Ultra-high-frequency vibration therapy

Ultraquiet, a new commercial innovation is a high-frequency bone conduction therapy that aims to reduce long term tinnitus severity by delivering amplitude modulated musical type tones in the range of 10-20 kHz. Research by Goldstein et al. (2005) pointed out four underlying mechanisms that contributed to relief: ultra high-frequency masking, residual inhibition, neurological reprogramming and habituation. Sensorineural hearing loss mainly in the higher frequencies is mostly accompanied with high pitched tinnitus (Shulman et al., 1991) and also leads to cortical reprogramming (Engineer et al., 2004; Lee et al., 2004). High-frequency stimulation aims at slowing down and reversing the process of cortical reprogramming, possibly even leading to the restoration of a normal frequency map.

2.8 Neuromonics tinnitus treatment

The Neuromonics Tinnitus Treatment, one of the newer sound-therapy approaches for tinnitus sufferers, uses a portable listening device to deliver a customized acoustic neural stimulus (Davis et al., 2007). The pocket-sized device emits a high-frequency (up to 12,500 Hz) acoustic stimulus that is customized and spectrally modified based on a patient's individual hearing profile. The use of the device in combination with the educational and

counseling program is intended to address the three components that together produce the problems most commonly experienced by tinnitus sufferers. These are: (1) audiological (hearing loss often triggers tinnitus), (2) neurological (how the brain responds), and (3) psychological (how people react to tinnitus). The high-frequency stimulation from the device produces an engrossing and enriching acoustic environment for the brain, thereby promoting neural plastic changes that counteract the effects of hearing loss on the tonotopic order in the auditory cortex (Sinopoli et al., 2007).

2.9 Sound stimulation therapy during sleep

Sound stimulation during sleep is one of the new strategies for treating subjective tinnitus. The stimulus is a sound that mimetized the tinnitus and was fixed at the same tinnitus intensity and then applied through an iPod. They proposed that the sound stimulation with the same characteristics in frequency and intensity as the tinnitus is a way of reinstalling the normal balance in the central level processing of information, hypothesizing that tinnitus emerges to replace an input deficit. This technique provides a treatment of tinnitus during sleep without interfering with the patient's daytime activities (Pedemonte et al., 2010).
Hearing aids, tinnitus maskers, and tinnitus instruments may provide relief for a proportion of tinnitus sufferers, however the success rate for each of these forms is not precisely known.

2.10 Tinnitus Retraining Therapy (TRT)

Our brains have the ability to select sounds that are important to us and to ignore those that are not (Jastreboff and Hazell, 1998). If the tinnitus is not important to the patient anymore then the patient should be able to ignore the sound even if it is still there.
TRT is a clinical implementation of the "neurophysiological model" of tinnitus (Jastreboff, 2004; Jastreboff & Hazell, 2004). TRT involves facilitating habituation to the tinnitus signal by a combination of retraining counseling and sound therapy with broadband noise as well as environmental sounds (Han et al., 2009). Patients with more troublesome tinnitus are advised to wear ear-level devices (sound generators, hearing aids, or combination instruments) to optimize the habituation process. These devices ensure a monotonous, low-level sound that reduces the relative strength of the tinnitus neural signal, which presumably makes the tinnitus signal "less detectable" by the brain (Jastreboff & Hazell, 1993). Reduced detection of the tinnitus signal by the brain at subconscious (subcortical) levels is thought to facilitate habituation of tinnitus-induced reactions and subsequently, habituation of tinnitus perception (awareness) at the conscious (cortical) level. The perception of sound can only then be habituated if it does not evoke an emotional response (Jastreboff & Hazell, 1998). Habituation of tinnitus means that the tinnitus-related neuronal activity is blocked from reaching the limbic and autonomic nervous systems and consequently there are no negative reactions to the tinnitus (habituation of reaction). Moreover, the auditory system is capable of blocking this tinnitus-related neuronal activity, preventing it from reaching higher cortical areas and thus being perceived (habituation of perception) (Jastreboff, P.J. & Hazell, J.W, 2006). Recognition of the importance of the contributory effects of the limbic and autonomic nervous systems is a major aspect of this treatment model. The long term impact of TRT is limited (Dobie, 1999) and it can take up to one to two years to observe stable effects. It has also been noted that there is a need for better experimental designs in the studies on TRT efficacy (Wilson et al., 1998; Kroener-Herwig et al., 2000).

Psychological forms of treatment for tinnitus have included progressive muscular relaxation training, biofeedback, hypnosis, and cognitive-behavioral intervention (Sweetow, 2000; Henry & Wilson, 2000). These types of therapy are not intended to remove or reduce the perceived tinnitus in any way, but help the patient to better cope with tinnitus.

2.11 Cognitive Behavioral Therapy (CBT)

The patient who is severely disturbed by tinnitus can be described as having additional emotional problems, such as depression or anxiety disorder. Treatment of these emotional problems, along with helping the patient to learn better coping strategies can often help the patient deal with their tinnitus (House, 1997). CBT is one of the psychological therapies that have been utilized in the treatment of tinnitus. It is a behavioral counseling technique designed to modify a person's emotional reaction to tinnitus. The goal of CBT in tinnitus treatment is to first recognize and then correct any maladaptive thought patterns about tinnitus (Tyler, 2006). The objective is to desensitize the individuals so that they can accept its presence and still choose to ignore it. The tinnitus sound is still there, however, it is the way in which the patient thinks about the tinnitus that results in specific reactions (Henry & Wilson, 2001). Studies have demonstrated that CBT helped patients reduce tinnitus related distress (Zachriat & Kroner-Herwig, 2004). However, not all patients require a major emphasis on cognitive behavioral therapy.

2.12 Virtual reality therapy

Following the analogy of CBT, the purpose is to act on the sub-cortical mechanisms of integration, thus allowing the patient to willingly manipulate the tinnitus in a visual and auditory 3-Dimensional (3D) virtual environment to control or "master" tinnitus (Londero et al., 2010). The application is based on the model of visual virtual reality coupled with accurate auditory spatial image, as well as a natural sensorimotor interaction provided through the use of two elements. The overall procedure consists of, in the first place, the creation of an auditory avatar (auditory image of patient's tinnitus), and secondly, the inclusion of an interactive auditory–visual virtual environment where the different audio components are spatialized according to the navigation and manipulation of the patient. Londero et al. (2010) believed that immersion in virtual reality can contribute to tinnitus treatment by promoting plasticity, through the active manipulation of a 3D auditory object linked to a visual representation.

Unilateral subjective tinnitus sufferers have the opportunity to voluntarily manipulate an auditory and visual image of their tinnitus (tinnitus avatar) in auditory and visual 3D virtual reality environments. In practice, the patients would be able to convert their subjective auditory perception of the tinnitus avatar and to have the advantage of the multimodal virtual awareness they experience in hearing, seeing and spatial control. Repeated sessions of such virtual reality immersions are then supposed to contribute to tinnitus treatment by promoting cerebral plasticity. Further, clinical research is necessary to demonstrate the clinical relevance in alleviating tinnitus.

2.13 Biofeedback therapy

Biofeedback is a relaxation technique which allows the patient to control certain autonomic bodily functions such as muscle tension, pulse and level of brain activity. The application of biofeedback technique in tinnitus management was first reported by House & colleagues in

1977. With the use of biofeedback, the patient learns to gain control of certain physiologic functions of his/her body with the help of a device that displays the results of this physiologic function electronically (Grossan, 1976). It is designed to train the patient in relaxation procedures that may help him/her to control his/her stress level and ultimately the tinnitus (Shulman, 1997). Biofeedback can help patients suffering from tinnitus, especially during rest (Podoshin et al., 1995). Electromyogram (EMG) activity is used to observe how relaxation techniques effect muscle relaxation. Treatment of tinnitus by EMG biofeedback is most effective (Podoshin et al., 1995). Studies have shown some promise in the relief of tinnitus from these techniques (House, 1978; White et al., 1986; Newman et al., 1997).

2.14 Neurofeedback therapy

Neurofeedback is a recent development in which brain waves are observed. The main categories of brain waves are Beta (awake), Alpha (calm relaxation), Theta (light sleep) and Delta (deep sleep). Neurofeedback is a form of biofeedback related to aspects of the electrical activity of the brain such as frequency, location or amplitude of specific EEG activity. Neurofeedback is a computerized learning strategy that enables people to voluntarily alter their own brain activity. Chronic tinnitus sufferers have different patterns of brain activity compared with those with normal hearing (Weisz et al., 2005). Many individuals with tinnitus have abnormal oscillatory brain activity. This pathological activity can be normalized by neurofeedback techniques (Weisz et al., 2005). This is achieved mainly through enhancement of tau activity (8-12 Hz activity as tau activity).

The brains of tinnitus sufferers showed that reduced Alpha power (8-12 Hz) and enhancement in the Delta (1.5-4 Hz) and gamma power (>30 Hz) brainwave range. These differences were especially pronounced in the brain's temporal cortical regions. Delta enhancement and Alpha reduction were strongly correlated with tinnitus-related distress variables with a focus on the right temporal and also left frontal cortex. The right temporal and left frontal cortex might be involved in a tinnitus-related cortical network, in which the temporal region is associated more with perceptual issues (aspects concerning the character of the sound, e.g., tonal or noise-like, loudness), and the left frontal region more with affective distress and motivational attention of tinnitus (the tinnitus becoming a signal of high importance, so that it draws the attention of the individual) (Weisz et al., 2005). A temporarily generated tau rhythm (8–12 Hz) and slow waves in the Delta range (3–4 Hz) have been used as a neurofeedback protocol to treat tinnitus. In other words, boosting Alpha frequencies and cutting Delta activity using neurofeedback have shown some success in reducing tinnitus (Crocetti et al., 2011). It has also been reported that the use of neurofeedback therapy to manipulate cortical networks can be helpful in reducing tinnitus loudness and distress (Schlee et al., 2008).

2.15 Bhramari Pranayama

Yoga, an ancient philosophy and practice undertaken as a path towards self-realisation, was originated in India in at least 1000 B.C. (Feuerstein, 1990). The beginnings of yoga have been traced to India's oldest sacred text, the *Rig-Veda* (Iyengar, 1991, 1996; Feuerstein, 2003). The word 'yoga' comes from the sanskrit word '*yuj*', which means to join or integrate, to make whole, to connect, or to unite (Iyengar, 1991, 1966; Feuerstein, 2003). A yogic technique, Pranayama, is a method of controlling "*prana*" or life force through the regulation of

breathing. It is the breathing process or control of the motion of inhalation, exhalation and the retention of the vital energy. Pranayama is an important aspect of yoga that deals with the connection between breathing patterns and emotional states (Fried, 1993). These techniques aim at reducing anxiety levels in individuals, increasing parasympathetic activity in the milieu of the autonomic nervous system and at times actually inducing great muscular stretching through specific body postures. A breathing technique in pranayama is used to control, improve or refine the breathing processes, thereby energizing the body and calming the mind (Samskriti & Franks, 1978). Paroxysmal Gamma brain waves produced during the Bhramari Pranayama (Vialatte et al., 2009) which is associated with positive thoughts, feelings of happiness and acts as a natural antidepressant. The Bhramari Pranayama is one such ancient 'Yogic' breathing exercise that not only includes a unique breathing technique, but also entails placing the body in a relaxing posture with simultaneous generation of a constant humming sound during the phase of expiration. The sound generated in BP is akin to the humming of a bumble bee (Ramdev, 2005). The individual also actively concentrates his/her mind (mindfulness) at the centre of the forehead while closing both ears using the thumbs and placing light pressure on the eyes using the fingers of each hand respectively. Though practice of Bhramari Pranayama has been advocated and documented for its benefits in combating situations like hypertension, insomnia and related anxiety states, its use as a self-induced sound therapy for treating tinnitus has rarely been reported (Pandey et al., 2010). Application of BP has been demonstrated to provide significant levels of relief in tinnitus.

In BP, pressing of the eyeballs leads to stimulation of the vagus nerve which in turn leads to activation of the parasympathetic nervous system (PNS). PNS is associated with a relaxed and calm state of mind and body (Speciale and Stahlbrodt, 1999; Zabara, 1992). Under the relaxing effects of PNS, autonomic nervous system facilitates to decrease the stressing effects of sympathetic nervous system and channels it towards more relaxed PNS. The neuronal reorganization or flexibility can be achieved by duplicating the activity across synapses (Hormuzdi et al., 2004). Repetitive and simultaneous activity of the parasympathetic system during the therapy sessions reduces sympathetic activity in the person and alleviates the anxiety and stress associated with the onset of an attack or the range of distress experienced during the acute tinnitus attack. Reorganization or rearrangement of neural synapses (plasticity) is depicted by the direct correlation observed in the activation of PNS and the reduction of tinnitus and its associated negative emotions (Alkadhi et al., 2005).

It is important to note that BP works as a self-induced sound therapy and is not only a mode to treat tinnitus but also, ocular compression as a part of BP addresses negative association in the limbic system via stimulation of the vagus nerve. There is also a third reason why BP is particularly important, as breathing is very closely related to the activation of the autonomic nervous system (Ballentine, 1976; Hirai, 1975; Brena, 1971). Slower, deeper and more regular breathing is associated with parasympathetic activation effectively leading to a condition described as calm and composed. Yogic breathing exercises can produce beneficial changes in emotional state (Harvey, 1983). BP employs a combination of acoustic therapies to produce a reduction in central nervous system accomplished by stimulating the auditory cortex for tinnitus relief, and to further stimulate parasympathetic nervous system, thus promoting a less negative emotional response.

It is reported that BP not only suppresses the sound of tinnitus, but it also effectively reduces the irritation and annoyance caused by the sound in tinnitus patients. BP has an advantage in cost effectiveness, as there is no maintenance of any kind of devices such as

tinnitus maskers, Walkman mini stereo systems and tinnitus instruments. Such practice of Bhramari Pranayama is quiet safe.

In the presence of various approaches for management of tinnitus, none of the traditional approaches have proved to be a universally superior. Indeed, it is generally accepted that no single technique proves to be effective in all cases. However, the combined therapeutic approach (consisting of Bhramari Pranayama, masking therapy and a herbal drug) has significant effects in the management of tinnitus (Pandey et al., 2010).

3. Conclusion

The answer to whether there is a cure for tinnitus may lie in the question itself. Tinnitus may help us in attempting to understand and reveal normal auditory perception. In a study conducted by Del Bo et al. (2008) people with normal hearing experienced tinnitus when kept in a sound proof chamber for 5-10 minutes. Therefore it can be said that the brain abhors silence and resorts to different mechanisms such as release from inhibition in absence of auditory input.

It is difficult to study and treat tinnitus because of the lack of objective tools to quantify and measure it, and as much as the symptoms vary, so does the treatment. There is no one answer for tinnitus treatment for all individuals, though single isolated effects for different individuals are reported. It is now evident that most forms of tinnitus are caused by changes in the function of the central auditory nervous system while these changes are not associated with any detectable anatomical lesion. The tinnitus may be the result of the expression of neural plasticity and anomalies may develop because of reduced input from the ear, lack of sound stimulation, overstimulation or as yet undetermined factors (Jastreboff, 1990). Many individuals have somatic tinnitus where movements of the eyes, head, neck, jaw and shoulder can change the loudness and pitch of their tinnitus. These findings may suggest the involvement of non-auditory centres in the pathogenesis and regulation of tinnitus. Recent advances in the imaging techniques have served to identify the aberrant neural activity that is associated with tinnitus perception. There is mounting evidence from functional neuroimaging studies that abnormal functioning (neuroplastic alterations) of the central nervous system is involved in the pathophysiology of chronic tinnitus (Eichhammer et al., 2007; Smits et al., 2007). Electrophysiological studies have shown a firing rate increase and neuronal synchrony associated with reduced Alpha and enhanced Gamma activity within primary and secondary auditory cortices that could be correlated to tinnitus-related psychological distress (Weisz et al., 2007). Recently, voxel-based morphometry (VBM) has been proposed for the identification of brain areas that display structural changes in tinnitus. A common genetic cause of tinnitus and depression is believed to be a serotonin transporter gene SLC6A4 and is reported as a potential candidate gene (Tyler RS, Coelho C, Noble W., 2006).

Patients with tinnitus present a variety of symptoms, and as a consequence, wide ranges of therapies are available for treatment. Although many of these therapies are effective when applied to individual patients, no study has yet been able to confirm one. Most successful management programs employ multimodal strategies designed to address the specific needs of each patient. A recent study described combined therapy (Bhramari Pranayama, Masking therapy and Ginkgo biloba) as being advantageous in treating patients with tinnitus. Applications of electrical stimulation of the ear through cochlear implants, stimulation to the vagus nerve and specific parts of the brain are already being investigated

for the treatment of tinnitus. Ocular compression in Bhramari pranayama has already been explained in the use of vagus nerve stimulation and the limbic system (Pandey et al., 2010). A continued effort coupled with ongoing research is needed to address the questions. A future goal will be to reach the consensus both for patient assessments and for outcome measurements.

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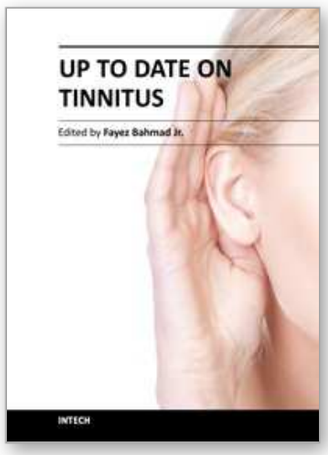
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Up to Date on Tinnitus encompasses both theoretical background on the different forms of tinnitus and a detailed knowledge on state-of-the-art treatment for tinnitus, written for clinicians by clinicians and researchers. Realizing the complexity of tinnitus has highlighted the importance of interdisciplinary research. Therefore, all the authors contributing to the this book were chosen from many specialties of medicine including surgery, psychology, and neuroscience, and came from diverse areas of expertise, such as Neurology, Otolaryngology, Psychiatry, Clinical and Experimental Psychology and Dentistry.

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