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# Past, Present, Future

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Significant happenings for tinnitus occurred in 1995. The year 1995 can be considered a landmark year at which time the past, present and future of tinnitus have been reviewed, plans set in place for continuation of activities of the present and their projection for the future. Events particularly in this past year of 1995 demonstrate the dynamic growth and development of the discipline Tinnitology.

The Fifth International Tinnitus Seminar which occurred in Portland, Oregon, July 12-15, 1995 was such an event. It was significant both for tinnitus patients and professionals involved in attempting to identify the basic science aspect of tinnitus as well as the clinical issues of tinnitus patient diagnosis/treatment/control. It embodied the past and present of the state-of-the-art of tinnitus and also a projection for its future.

The highlights of the meeting are considered to have included the following:

1. Epidemiologic studies provided significant information for improvement of understanding of the clinical course of tinnitus and its relationship to associated complaints highlighted by that of hearing loss, vertigo, and other abnormal auditory sensations. Significant numbers of patients who completed questionnaires associated tinnitus with complaints of previous disease, noise exposure, social factors, etc. Random studies of tinnitus and lifestyles show a significant relationship to health, perception, social functioning, mental health, and the overall vitality of the patient. Significant impact of tinnitus on the quality of the individual's life and lifestyle has been clearly established. The particular problem of pediatric tinnitus demonstrate the need for intervention and hearing conservation programs commencing in schools. The identification that geriatric tinnitus presents special problems has been identified and reaffirmed.

2. Assessment measures necessary for measurement of tinnitus per se of absolute loudness, loudness recruitment, residual inhibition were presented.

The development of a tinnitus handicap inventory is now available and may have a practical application for medical/legal issues of impairment, handicap and disability - specifically for tinnitus. The factor of stress,

acknowledged by all patients to be significant in the clinical course of tinnitus can be approached by a tinnitus stress test. The results can be applied for suitable counselling; monitoring both of the perceived effects of tinnitus treatment; a method to monitor the efficacy of control/relief techniques for tinnitus control; and to establish a baseline of affective response prior to initial consultation. Psychoacoustic characterization of tinnitus elicited by a neuropsychological model of tinnitus postulates that the loudness comfort level influences the plan of tinnitus treatment; predicts the rate of tinnitus improvement with therapy; and that the loudness comfort level and minimum masking level correlate with the clinical course of tinnitus in response to the proposed plan of therapy.

Factors contributing to tinnitus loudness are reported to be, in the order of magnitude of correlation, the hearing threshold level in the ear with tinnitus, pitch match frequency, and age. Otoacoustic emissions testing in tinnitus patients with normal hearing suggest that: a) half of the population examined had spontaneous otoacoustic emissions; b) below 1000 Hz all tinnitus patients produced distortion product otoacoustic emissions (DPOE); c) the mean slope of the distortion produce emission input/output function in tinnitus patients was not as steep as that of the control group. A possible relationship between subjective intensity, tinnitus frequency and hearing loss at the same frequency of the tinnitus has not been able to statistically identify a significant relationship between these parameters. The need for future objective methods for identification of tinnitus intensity has been reconfirmed. Another reported spontaneous emissions to be a cause for tinnitus in a very small proportion of patients, effecting approximately 1%. Otoacoustic emissions in tinnitus patients are being applied for ongoing tinnitus research, and its application for patient diagnosis/treatment.

Significant was the report of a UK National Study of Hearing which reviewed the data of epidemiologic studies on tinnitus. The significant determinants for tinnitus were considered to be age, noise, and the associated economic group. The prevalence of tinnitus and its severity is considered to depend primarily on the amount of hearing disorder rather than cause. It was proposed that its application for classification be based

on cause, type, and site of lesion. Significant differences were found in patients with a conductive loss of hearing i.e., the incidence of occurrence of asymmetric tinnitus was high. This supports the experience reported in the past of the influence of the middle ear on tinnitus particularly the parameter of intensity.

3. Tinnitus models were presented and included: a) a neurophysiological model; b) final common pathway for tinnitus and a stress model; c) electrophysiologic models - all of which have practical applications both for increasing the accuracy of tinnitus diagnosis and treatment.

The neurophysiologic model presented has particular attraction because of past and present reports of the need to identify process(es) involved in the transition/transformation of the sensory to the affect component of tinnitus and its application for tinnitus treatment i.e., habituation. Clinical components of the symptom of tinnitus have been identified and reported in the past to include the sensory, affect and psychomotor. The non-lemniscal auditory pathway was presented and is of a particular interest for research in regard to the psychomotor and affect components of the clinically identified tinnitus.

The concept of a final common pathway for tinnitus and the role of stress in the medial temporal lobe system of brain may unify all models, present and future, which attempt to explain the clinical manifestations of the behavioral/emotional change in patients with tinnitus particularly of the severe disabling type.

Examination of visual evoked responses in patients with tinnitus report that tinnitus patients differ only at the information processing level of brain. An electrophysiological investigation of auditory attention under normal and tinnitus patients identified an evoked response which may represent a electrophysiologic correlate of tinnitus perception.

A technique of spectral averaging of responses from a surgically exposed auditory nerve and round window in animals and humans identified a peak near 200 Hz but not in all subjects having pre-or-post operative history of tinnitus. The conclusion of this study, which attempts to provide an objectivization for measuring tinnitus, indicates that not all disorders causing tinnitus are associated with such a peak. Spontaneous activity from the auditory nerve can be recorded in a non-invasive manner from the middle ear in humans. This suggests a clinically applied technique for identification of tinnitus particularly of a cochlear and/or neural types.

4. Attempts to identify tinnitus mechanisms included reports utilizing functional magnetic resonance imaging (MRI) studied brain activation in subjects with subjective

tinnitus evoked by eye gaze. The use of high dosages of salicyl and quinine to determine temporal coding in cat auditory cortex reported findings which were considered significant with respect to potential treatment. Results in this model support involvement of a calcium dependent mechanism at a cortical level for some forms of tinnitus particularly that related to salicyl and quinine.

5. For the present, the establishment of a tinnitus diagnosis by a medical audiologic team approach is increasingly being applied in an attempt to establish an increased accuracy for tinnitus diagnosis. Preliminary investigations of brain mapping and imaging were reported as observations in patients with the symptom of tinnitus and vertigo. Imaging techniques including brain electrical activity mapping (BEAM), single photon emission computer tomography (SPECT), positron emission tomography (PET), magneto-electroencephalography (MEG), and functional MRI - all - offer the potential of an insight into the medical significance of tinnitus underlying mechanism of tinnitus production; and specifically neurologic/neurotologic implications both for tinnitus diagnosis/treatment. Diagnostic techniques of brain mapping/imaging with SPECT, functional MRI - all - provided preliminary data which identified multiple regions of interest in brain with perfusion and electroencephalogram (EEG) asymmetries. For the first time, in vivo, with SPECT, objective asymmetry in multiple areas of brain consistently in the left temporal lobe has been demonstrated in consecutive tinnitus patients clinically identified to be of the predominant central type. Increased blood flow in important auditory regions gives us for the first time a starting point to investigate pathophysiologic mechanisms of a predominantly central type tinnitus.

6. The clinical presentations of diagnosis/treatment were highlighted by increasing discussion of different types of tinnitus, referred to as clinical type or central tinnitus or cochlear tinnitus.

Multiple treatment modalities were reviewed. Although no cure exists for tinnitus, multiple modalities of therapy are available to attempt to provide a significant incidence of occurrence of relief to the tinnitus patient. The advice "learn to live with it" should no longer be given to tinnitus patients.

Instrumentation continues to provide the greatest incidence of relief, i.e., hearing aid, masker, tinnitus instruments and now the newly described inhibitor and habituator. Excellent results with habituators and external electrical stimulation was presented. Of particular interest is the habituation method of tinnitus treatment. Habituation is a re-training therapy wherein

the patient is conditioned to a sound stimulus other than that of their tinnitus and, over time, results in significant reduction in awareness of the tinnitus perception. Differentiation was made between habituation and masking. For external electrical stimulation the problem remains of patient selection, identification the mechanism of action, and the long term effects of electrical stimulation. Of interest is a new small tinnitus inhibitor which can be programmed with a computer and PC software package in an attempt to influence residual inhibition by puretone signals in bands of noise.

Although there is no one specific medication for tinnitus treatment, multiple preparations used alone and/or in combination are in use and positive results have been presented. Caution is advised for the need of patients to understand the rationale for use of a particular medication. Significant relief has been reported by the use of anxiolytic and antidepressant drugs i.e., Xanax®, Klonopin®, Nortriptylene®, etc. Results support clinical reports of the need to recommend therapy based upon differentiation between the sensory and affect components of the symptom of tinnitus. The role of patient support with counselling and specific techniques of cognitive therapy, and biofeedback, are reflected in positive results reported for tinnitus relief and are significant.

Alternate methods of therapy were presented and included temporo-mandibular joint (TMJ) therapy, hyperbaric treatment, external laser application with or without ginkgo use.

7. Significant was an organizational meeting to attempt to establish an international classification system for tinnitus which can be accepted by all professionals involved with tinnitus. Its significance will be to provide a reference for both professional and patient. When one is dealing with an idiopathic symptom i.e., tinnitus, classification is essential for both diagnosis and treatment. The international audience and multiple disciplines who attended the meeting reflect the growth of interest in the symptom of tinnitus and the development of a discipline that has been identified as Tinnitology. The International Tinnitus Advisory Group of the International Tinnitus

Seminars decided to change its name to the International Tinnitus Study Group (ITSG). Recommendations of the Executive Advisory Committee of the International Tinnitus Study Group, as reported in 1995 in the International Tinnitus Journal, Vol.1, No.1, were declined. The original International Tinnitus Study Group has been renamed "The International Tinnitus Forum (ITF)." The ITF will continue to meet at the time of the American Academy of Otolaryngology Head and Neck Surgery (AAO-HNS) Annual Meeting. The next meeting of the ITF will be in Washington, D.C. September 28, 1996 prior to the AAO-HNS Meeting September 29 - October 2, 1996. The meeting is open to all who are involved in the symptom of tinnitus.

All who attended the Fifth International Tinnitus Seminar were pleased to have had the opportunity to express appreciation to Jack A. Vernon, Ph.D. for his pioneering efforts for tinnitus. The American Tinnitus Association (ATA), continues to be an organization which provides leadership to all patients and professionals involved in the symptom of tinnitus. Transactions of the meeting, in detail, will be made available by the ATA. We thank the ATA and its staff who made the Fifth International Seminar a success.

This issue of the International Tinnitus Journal is considered to reflect future directions of both basic science, and clinical efforts for tinnitus diagnosis/treatment. Letters from readers are encouraged to be submitted. Together, both patient and professional, will realize the goal of the ITJ which is a cure for different types of tinnitus produced by different mechanisms of tinnitus production, initiated by multiple etiologies.

The ITJ, which has had its inauguration in 1995, consistent with its goals, will continue to present opportunities to all professionals and patients to express their opinions, views, theories. Tinnitology is not yet a science. Tinnitus investigation is still in an early stage of development. Many different observations, opinions, and speculations are being presented. Flexibility in thinking both by basic science and clinical aspects of the problem of tinnitus are required to allow for the continued development of new modalities in both diagnosis/treatment and the control of tinnitus.