

POST- DOCTORAL FELLOWSHIP PROGRAMME IN **AUDIOVESTIBULAR DISEASES**

SYLLABUS

Course Duration : 2 years

Title of the course

Post Doctoral Fellowship in Audiovestibular Diseases

Name(s) of the department offering the course

Department of ENT, Head & Neck Surgery, Speech and Hearing that has the capacity and expertise to train students as per requirements given below.

Name of the proposer and coordinator

*Dr. Anjali Lepcha Professor and Ag. HOD ENT services
ENT Department Christian Medical College, Vellore, Tamilnadu*

Any other collaborating centre

None at present

Entry criteria:

MS in ENT

(2 years post – MS in academic ENT)

Duration of the Course

Two years

Number of Intake

one candidate per year

Anticipated competencies a candidate will acquire:

BROAD OBJECTIVE

This post doctoral fellowship program will be the first of its kind in India and is aimed at delivering the broadest spectrum of clinical training in audiovestibular specialty to deal effectively with hearing and balance problems in adult and pediatric age groups. The purpose of the training program is to provide a holistic approach to clinical care and research in audiovestibular conditions.

SPECIFIC OBJECTIVES:

Will be at capacity building of the trainee's skills in

- A. Clinical science
- B. Research
- C. Teaching

A. CLINICAL SKILLS

To make the trainee competent:

1. To diagnose a wide range of complex audiovestibular conditions affecting children and adults in India.
2. To use available options for treatment and choose the most appropriate among them that is applicable to conditions prevailing in India.
3. To sensitize the trainee towards the need for improvement in health-care delivery in the field of audiovestibular conditions in India with reference to preventive, diagnostic, curative and rehabilitative services.

A. RESEARCH SKILLS

The trainee would be expected to

- Actively be involved in on-going research activities of the training department.
- Complete a prospective research project during the 2 year training period
- Publish the work in a peer-reviewed journal.
- Present a paper at the annual conference of the Association of Neuro-otology and Equilibriometric society of India.

Through participation in an existing Research Methodology course, the candidate is expected to gain insight into the methodology of clinical research including the design and planning, analysis of data, simple statistical methods and finally the nuances of logical presentation of the data in a scientific communication.

A. TEACHING SKILLS

The trainee would be expected to gain teaching experience through resident and medical student programs, conferences and staff contact.

Background and the need for the course

This course is presently not available in India. For reasons stated below, this course should be offered in India.

Audiovestibular sub-specialty is a branch of ENT concerned with the prevention, investigation, diagnosis and management of adults and children with disorders of hearing and balance and tinnitus.

As the field of ENT is expanding rapidly it has become necessary to sub specialize to address the need of treating patients with hearing and balance disorders. Even though this subspecialty is not present in India, it is a well recognized subspecialty of ENT practice in United Kingdom with a Specialist Advisory Committee, based on approval from Royal College of Physiciansii

Hearing and balance problems from 10 to 25 % of a general ENT practice. The burden of hearing loss among adults is large. According to WHO estimates, some 413 million people suffer from mild or greater hearing loss globally, an estimated 187 million people from moderate or greater hearing loss, and 46 million people from severe or profound hearing lossⁱⁱⁱ. In India, the incidence / prevalence of hearing loss in school age population is about 11.3%^{iv}. The National Sample Survey Organization (NSSO), Government of India 1991 report shows that in rural India 2.7 % are children with hearing impairment in the age group 0 to 14 years. In the same age group, urban statistics are 3.0 % and for speech disability it is 8.9% and 8.3% of the rural and urban areas respectively^v.

Vertigo and balance problems are another major morbidity in the population. A population study done by Raman et al^{vi} in their survey of rural population in India found a prevalence of 7% of people over 60 years presented with vertigo. The 1991 Census indicated that 6.58 percent of the total population belonged to the 60 plus age group. This proportion is expected to go up to 7.08 percent by 2001 and 9.87 by 2021^{vii}. *As this group proportion population increases, so will the absolute numbers of Vertigo and balance disorders in the country and preparation to meet the demand will have to be done now.*

Current postgraduate training in ENT covers some aspects of audiovestibular specialty. However it does so on a very superficial and inadequate manner mainly because of the demand by the surgical aspects of ENT.

The establishment of Audiovestibular specialty stems in part from the **changing patterns of the aetiology of hearing and balance disorders**, although caused predominantly by infectious conditions, more and more cases are now being recognized to be due to **genetic, traumatic and degenerative disorders**, few of which are amenable to surgical treatment alone. This training programme is designed to equip the trainee with a high level of training in all aspects of the specialty.

Audiovestibular specialists are required to work closely with other professionals like audiologists, speech therapists, geneticist and psychologists and radiologists. They hence need training in a wide variety of other specialties.

In addition to the rehabilitative aspects of the chronic disorders encompassed within the specialty, a broad general medical training allows appropriate investigation and medical and surgical management of the plethora of conditions of both peripheral otological and central nervous system origin, presenting with acute audio-vestibular symptoms, including infectious, inflammatory, vascular, traumatic and metabolic disorders. A multidisciplinary approach is adopted towards diagnosis and management of these problems, including tinnitus, dysacusis and communication disorders, aimed at improving the well-being and quality of life of the individual concerned.

Training in this specialty would hence include learning aspects of Developmental Pediatrics, Geriatrics, Medical Genetics, Neurology, Ophthalmology, Otolaryngology and Psychiatry, on a background of MS ENT. **This breadth of training facilitates continuing research and development into methods of prevention of two of the most common sensory disabilities**

Entry criteria:

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Duration of the Course

Two years

THE NUMBER OF TRAINEES

Two (see note below)

It is emphasized that for any admission year not more than two Fellows should be under training. The number of candidates to be enrolled per year would depend on the number of operating list and annual workload. With an outpatient of 100 patients in a audiovestibular clinic each week, along with participation in diagnostic and rehabilitative procedures in the Audiovestibular lab will generate enough work for two fellow per year. Since the duration of the Fellowship is two years, only two candidates should be selected each year for this level of clinical activity. A higher level of clinical activity could aim for more candidates using the above work load as the benchmark.

Anticipated competencies a candidate will acquire:

BRIEF SYLLABUS

The trainee will have exposure to a wide range of audiovestibular disorders in adults and children that are encountered in clinical practice. A large volume of experience will involve the management of hearing loss secondary to middle ear and inner ear disorders. The trainee will gain experience in surgeries done for correction of hearing impairment like tympanoplasty, mastoidectomy, ossicular reconstruction, and cochlear implants as well as surgeries for vertigo like repair of perilymph fistulae, endolymphatic sac surgeries and labyrinthectomy.

The trainee will attend regular audiovestibular clinic which occurs twice a week.

Patients will be worked up, examined, investigated and treated (medically and surgically where appropriate) under supervision.

In addition to providing dedicated medical and surgical experience in management of audiovestibular conditions, the trainee will have exposure to a variety of specialized clinic experiences such as pediatric ENT and Hearing Aid clinics, there would be an educational tie-up with the departments of Neurology, cardiology, endocrine, rheumatology, developmental pediatrics, psychiatry and medical genetics.

**DETAILED SYLLABUS FOR 2 YEAR POSTING FOR POST-MD
FELLOWSHIP IN AUDIOVESTIBULAR MEDICINE**

Module 1.1**Topic 1 - Physical Acoustics**

At the end of the module the candidate will be able to explain

- [/] The various characteristics of sound and how it impacts on the function of hearing.
- [/] How sound waves interact with physical objects
- [/] Formation and impact of standing waves
- [/] How sound waves propagate, and how the propagation alters when sound is transmitted between different media.
- [x] Explain the principles of room acoustics (*insulation, echo, reverberation, and requirements for audiometric test rooms*).

Topic 2 - Signals.

The focus of this topic is the measurement of sound in octaves and decibels. By the end of the topic, students will be expected to be able to explain:

- Basic concepts about common waveform types including sine, square, white noise, pink noise, band-limited noise, frequency and amplitude modulated signals, gated, compressed, threshold and clipped signals

- Explain the various characteristics of sound their measurement and their properties.

Topic 3 - Signal Processing and Systems.

This topic focuses on acoustic resonators and on signal enhancement methods. At the end of the topic students will be able to explain:

- ∟ The nature of signals and noise, and their quantitative description
- ∟ The use of synchronous signal averaging for signal enhancement. Filtering and band limiting, type of filters, their quantitative description and the advantage of filtering for signal enhancement
- ∟ The identification and description of noise contamination within signals

Topic 4 - Calibration and Instrumentation.

The focus of this topic is on calibration and instrumentation. At the end of the topic students will be expected to explain

- ∟ The purpose of calibration
- ∟ Principles of acoustic calibration
- ∟ Specific calibration techniques appropriate to response measuring equipment and clinical audiological instruments.
- ∟ Performance of sound field measurement, weightings etc.

Topic 5 - Signal Processing and Enhancement for Physiological Signals.

This topic will focus on the basic principles and mechanism of generation, properties of otoacoustic emissions and its application in clinical setting.

Topic 6 - The Auditory Periphery - A Systems Approach.

To understand this topic, students will need to be adequately familiar with the anatomical details of the peripheral auditory system, which will be reviewed within this section. Following this topic, students should be able to:

- ∟ Describe the transformations in signals that occur throughout the peripheral auditory system.
- ∟ Trace the signal in its transmission and analysis through the middle ear, through the cochlear travelling wave system and finally to the intracellular potential of the inner hair cells and the activity of the auditory nerve.
- ∟ Describe the filtering mechanism of the cochlea, its parameters, its origin, its value and the changes, which occur during cochlear disorder.
- ∟ The transduction mechanism by the hair cells in the inner ear.
- ∟ The response of the auditory nerve (physiological, pathological)
- ∟ The filter-bank analogy.

Topic 7 - Basic Psychoacoustic Phenomena.

Following this topic, students will be expected to be able to explain the nature, basic principles and measurement of the following psychoacoustic phenomena:

- ∟ Equal loudness
- ∟ Binaural hearing: Localization of sound
- ∟ Masking release
- ∟ Loudness / Pitch / Timbre
- ☑ Frequency selectivity (*the filter – bank analogy*)

// Temporal analogy

Module 1.2

Module 1.2 – Statistics

The aim of this module is to teach the student the basic methods for collecting, summarizing, presenting and analyzing data. This knowledge must be integrated into the research project and will also enable the student to judge the importance and value of findings that were published in professional journals.

Module 2: Anatomy and Physiology

Objectives of module

The aim of this module is to provide an understanding of the auditory and vestibular systems proceeding from the gross anatomy of the ear to the more detailed structure of the cochlea and vestibular organs. It will be aimed at providing an overview of the structural and functional relationships of the various components of both auditory and vestibular systems in the transmission and processing of external stimuli passing from the peripheral sensory cells to the cortex. The module will also be aimed at providing an outline of the normal embryological development of the auditory and vestibular systems and how genetic defects may affect these processes. Consideration will also be given to the way in which ototraumatic agents (*drugs, noise, disease*) result in damage to both systems, and may lead to repair and regenerative mechanisms.

Topic 1. Cell and molecular biology

Topic 2. Gross anatomy and embryology of the ear

Topic 3. Structural and functional relationships in the cochlea and vestibular system

Topic 4. The auditory pathway - efferent and afferent pathways.

Topic 5. Effects of oto-trauma on the inner ear and the central auditory pathway

Topic 6. Physiology of the auditory system

Topic 7. Embryology and molecular aspects of the development of the inner ear at the cellular level

Topic 8. Effects of loss of sensory input in development

// Genetic failures in development of the auditory system and the effects of sensory loss on the auditory pathway at different stages of development.

// Relevance of this knowledge in terms of cochlear implants in sensorineural deaf children.

Topic 9. Repair and regeneration in the inner ear

Topic 10. Physiology of the vestibular system

Module 3: Audio-Vestibular Diagnostics

Objectives of Module: To get hands on experience in carrying out the diagnostic procedures with knowledge of basis for doing these tests and interpretation of tests

Topic 1: Pure-tone audiometry:

Principles behind the test, procedure including masking, interpretation in clinical setting

Topic 2: Middle ear impedance audiometry

Principles behind the test, procedure, interpretation in clinical setting

Topic 3: Clinical tests and examinations**Topic 4: Otoacoustic emissions**

▮ Background and introduction

▮ Advanced OAEs – use, artifacts, hearing screening and diagnostic applications

Topic 5: Electrophysiology

▮ ABR, ASSR, EcochG,

Topics 6 & 7: Test of balance function – vestibulometry

▮ Overview of vestibular disorders

▮ Labyrinthine disorders: Meniere's, BPPV, common central vestibular disorders

▮ Techniques of eye-movement recording: AC and DC, video oculography, coil and infra-red, basic principles

▮ Electronystagmography: Gaze, saccades, OKN, VOR, VORS, impulse rotation - assessment of vestibular function using ENG test battery

▮ Scientific basis of caloric testing: Technique (*creating a thermal gradient in the canal*), COWS, CP, DP, Jongkees formula, combined patterns, other parameters, effect of fixation removal on SCV and duration in different pathologies, fixation index, advantages and disadvantages of the caloric test

▮ Scientific basis of rotation tests: Impulse and sinusoidal; passive and active rotation tests

▮ Scientific basis of static and dynamic posturography.

Topic 8: Paediatric Testing

▮ Behavioral tests in children.

▮ Objective assessment of auditory function in children

▮ Principles of hearing screening in children (PW)

▮ Assessment of tinnitus, Tinnitus matching and masking

Topic 10: Diagnostic testing strategy

▮ Application of tests as part of a diagnostic testing strategy

▮ Relationship between test results

▮ Dealing with conflicting and supportive data

▮ Writing patient reports

▮ Patient confidentiality

▮ Health and safety issues

▮ Case Histories - adult rehabilitation, neuro-otology and paediatrics

Module 4

Clinical Sciences Allied to Audiological Medicine

Basic Programme

Objectives of Module:

The range of disciplines allied to Audiological Medicine included in this module should provide the students with the foundation to understand the pathological, immunological and genetic mechanisms underpinning medical conditions presenting with vestibular, and/or auditory dysfunction. There will be postings of 2 weeks in the following department's rheumatology, neurology, Cardio electrophysiology with the opportunity to observe and interact with specialists in these fields

In addition the basic principles of radiological investigation and imaging techniques will be covered. The speech component given will provide a basis of knowledge of speech and language disorders and provide an understanding of the effect of deafness on the development of speech.

The module is divided into two sections as follows:

Module 4.1

This will comprise Pathology, Speech and Language, Genetics and Radiology.

Topic 1: Pathology

- // Aspects of general pathology
- // Pathology of the conditions of the external, middle and inner ear
- // Tumors of the external and middle ear
- // Pathology of choleastatoma and epithelial migration
- // Pathology of noise-induced hearing loss, ototoxicity
- // Pathology of the vestibular system
- // Neuropathology

Topic 2: Speech and Language

- // Neuro-mechanism of speech
- // Development of normal speech, language and communication
- // Assessment of speech, language and communication
- // Communication options for profoundly deaf children
- // Role of speech and language therapy for deaf children
- // Development speech and language disorders
- // Role of speech and language therapy for children with other communication disorders.

Topic 3: Genetics

- // Basic models of inheritance
- // Non-syndromic genetic hearing loss
- // Syndromes including hearing loss

- [/ Clinical approach to genetic hearing loss, including family history and pitfalls
- [/ Genetic counseling

Topic 4: Radiology

- Imaging equipment and techniques to visualize the structures of the middle and inner ear
- Radiological demonstration of normal and abnormal anatomy of the middle and inner ear
- Demonstration and extent of disease processes and, if possible, indication of the nature of the lesion

Module 4.2

This will comprise Immunology, Ophthalmology, Psychiatry, Clinical Governance and Evidence-Based Medicine.

Topic 1: Immunology

- [/ Innate immunity
- [x] Acquired immunity (*humoral and cellular*)
- [/ Hypersensitivity Types I - IV including mucosal immune function, middle ear immunity, effects of nasal disease on middle ear, and audio-vestibular manifestations of auto-immune disease

Topic 2: Ophthalmology

- Value of ophthalmology in hearing and balance disorders

Topic 3: Psychiatry

- Psychological aspects of tinnitus
- Psychological disorders in hearing-impaired children and adolescents; psychiatric disorders in hearing – impaired adults
- [/ Psychiatric disorders and vestibular function
- [/ Behavioural therapy in vestibular disorders

Topic 4: Clinical governance and evidence-based medicine

- [/ Understanding of evidence-based medicine
- [/ Methodology of critical appraisal of scientific/research papers
- [/ Planning, conducting and writing up research projects
- [/ Oral presentation of scientific/research data

Module 5: Vestibular Medicine and surgery

Objectives of Module:

This will cover all aspects of balance including epidemiology; overview of causes of balance problems in children and adults; diagnostic strategies; interpretation of tests; management of dizzy patient, and surgical intervention in specific disorders where appropriate and rehabilitation. Trainees will attend the audiovestibular clinics being held twice a week and will manage under guidance of the teaching staff

- ∟ The vestibular system and balance in man, including the vestibulo-ocular reflex and the vestibulo-spinal reflexes, smooth pursuit, saccades and optokinetic nystagmus together with strategies used for balance with an understanding of the normal development of balance in childhood, ageing of the vestibular system and balance mechanisms, in terms of both anatomical and physiological changes.
- ∟ Pathophysiology of deranged balance and vestibular function, abnormal eye movements.
- ∟ Physiological basis and techniques of vestibular function tests, with specific reference to (a) the caloric test, (b) the rotational test, (c) posturography, (d) vestibular myogenic responses, (e) vestibular perceptual tasks, and (f) otolith tests.
- ∟ Knowledge of a diagnostic approach for the evaluation of dizziness and falls in both the adult and pediatric population.
- ∟ Management of the clinical presentation, methods of diagnosis, and outline management of specific vestibular disorders including surgical interventions

Module 6: Clinical Auditory Medicine and Surgery - Children and Adults

Objectives of Module:

To provide the student with knowledge of medical conditions affecting hearing in children and adults. The importance and methods of hearing screening and assessment of the hearing of a child of different chronological and developmental age will be taught.

Effects of deafness on speech and language development, its psychological consequences and the methods of management of deafness.

- ∟ Epidemiology of hearing impairment and tinnitus in the adult population
- ∟ The normal physiological ageing process versus pathology
- ∟ Ageing of the auditory system in terms of anatomical/histological and physiological changes.
- ∟ Relevant pathology, clinical presentation, methods of diagnosis and management of specific auditory disorders.
- ∟ Conditions of the external and middle ear - acquired and congenital:
- ∟ Conditions of the inner ear
- ∟ Central auditory disorders
- ∟ Metabolic/renal/vascular/neurological/immunological disorders presenting with hearing impairment.
- ∟ Clinical Assessment of hearing impairment:
- ∟ Surgical management of hearing loss:

Adult Auditory Rehabilitation

- ∟ Methods of assessment of disability/handicap models of rehabilitation
- ∟ The components of an auditory rehabilitation programme
- ∟ Management strategies of tinnitus, assessment of its effect on patients, treatment of identifiable pathology, reassurance, retraining programme.
- ∟ Surgical and medical management of tinnitus.

Auditory Medicine in Children

- ∟ Epidemiology of sensorineural hearing loss, otitis media with effusion, tinnitus in childhood.

- [/ Development of the normal/abnormal/handicapped child and of auditory behaviour/attention.
- [/ Handicapping hearing loss in a child and effect of conductive or sensorineural loss on development of speech and language
- [/ Identification of hearing impairment

Screening

- [/ Historical perspective and evolution of screening for hearing impairment
- [/ Principles of screening and its advantages and disadvantages
- [/ Setting up a screening programme
- [/ Quality standards and outcome measures
- [/ Types of screening programmes:
- [/ Surveillance
- [/ Raising and maintaining parental and professional awareness
- [/ Importance of parental concern

Audiological Assessment

- [/ Evaluation of audiological responses in children with neuro-developmental problems
- [/ Effect of neuro-developmental problems on auditory behaviour
- [/ Audiological responses in children with visual impairment
- [/ Compounding effect of dual sensory impairment
- [/ Difference between screening and diagnostic tests
- [/ Distraction, co-operative and performance tests.
- [/ Behavioral Tests:
 - o Behavioral observation audiometry
 - o Visual reinforcement audiometry.
 - o Pure tone/warble tone in sound/closed field
 - o Speech discrimination tests
 - o Test for central auditory dysfunction
- [/ Objective Tests:
 - o Tympanometry
 - o Acoustic reflexes
 - o Auditory brainstem responses
 - o Electrocochleography
 - o Middle and late latency responses
 - o Otoacoustic emissions
 - o Protocols for sedation
- [/ Knowledge of diagnostic strategy for evaluation of a child presenting with hearing impairment or speech delay.
- [/ Medical conditions in children presenting with hearing impairment
- [/ Relevant pathology and clinical presentation of specific auditory disorders - acquired/congenital.
- [/ Conditions of the external, middle and inner ear, such as :

Meatal atresia	Otitis media
Glue ear	Cleft palate
Disruption of ossicular chain	Ototoxicity
Noise-induced hearing loss	Rhesus incompatibility
Hereditary loss	Non-organic hearing loss
Unilateral deafness	Tinnitus in children
Bacterial and viral conditions causing sensorineural hearing loss	
Metabolic and endocrine causes of sensorineural hearing loss	
Syndromic, non-syndromic causes of sensorineural, conductive or progressive hearing loss.	
Central auditory disorders.	

//Relations between speech and language disorders and behaviour disturbance/autism.

//Psychiatric aspects of working with the deaf child and his/her family

//Aetiological investigation protocols

//Importance of investigations at different ages

//Management of children with hearing problems

//Recognition of the linguistic, psychological and social effects of the various types and degrees of hearing loss.

//The multidisciplinary approach to the hearing impaired child and family, to the choice of communication methods, to children with complex problems, to promotion of active family/ carrier involvement.

//Roles of others (audiological scientist, medical technical officer, child psychologist (educational, clinical) deaf community worker, social worker, speech and language therapist, teacher of the deaf, educational audiologist, clinical geneticist, ENT surgeon, ophthalmologist, pediatrician, plastic surgeon, psychiatrist.

☑ Selection of hearing aids according to its physical and electroacoustic characteristics (i.e. body worn, behind the ear, in the ear), ear moulds, hooks, tubing, battery technology, adaptations for young infants and special needs children, output limiting, gain-frequency response.

//Appropriate choice of hearing aid systems - bone-anchored hearing aids, vibro-tactile aids, and frequency transposition aids, programmable aids, cochlear implant.

//Selection of FM/infra red systems

☑ Verification of function (*behavioral and electroacoustic methods*)

//Counseling / monitoring of hearing aid users and their families

//Cochlear implant:

Protocols of selection

Assessment

Surgery

Post-operative management and rehabilitation

- Access to health and social services for children and adolescents with hearing impairment.

Hence in the two year period the trainee would be posted in various collaborating departments. The schedule being

Parent audiovestibular medicine	14 months
General ENT	3 months
Pediatric ENT	4 weeks
Neurology	4 weeks
Radiology	1 week
Psychiatry	1 week
Developmental Pediatrics	2 weeks
Research posting	4 months

Community posting : Trainee will spend 3 hours a week of the last 6 months of the trainee period in one of the primary and secondary care hospitals where she/he will be dealing with only patients with giddiness and hearing problems.

Evaluation

1) INTERNAL EVALUATION

Periodic internal assessment would be carried out to assess the progress of the candidate during the training. The format of the assessment is appended.

2) EXIT EXAMINATION

On completion of 24 months training, the candidate would be eligible for appearing for the exit examination provided the periodic internal evaluation has been rated as satisfactory.

The examination would be conducted by the department.

2.1 THEORY EXAMINATION

The theory examination of 100 marks would include MCQ's : 50 marks.

Restricted response questions: 50 marks

Care should be taken to ensure that *all aspects of audiovestibular medicine are covered.*

2.2 CLINICAL EXAMINATION

The candidate would be permitted to appear for the clinical examination ONLY after qualifying in the theory examination.

It is recommended that the practical examination should include *Objective Structured Clinical examination* in addition to case discussion.

Examiners: As per the institutional policy.

2.3 VIVA-VOCE

Care would be taken to ensure that the viva-voce covers areas not evaluated in the theory and practical examination.

Award of the Fellowship

The Fellowship would be awarded after the panel of examiners has certified that the candidate has successfully passed all the sections of the exit examination.

RECOMMENDED TEXT BOOKS

Katz J Burkard R, Medwetsky L [2001] 5th edition Handbook of clinical audiology Lippincott Williams & Wilkins Publishers

Yost WA (2000) Fundamentals of Hearing 4th edition Academic Press
Baloh RW, Honrubia Veds (2001) Clinical Neurophysiology of Vestibular system 3rd edition Philadelphia: Davis. Contemporary Neurology Series

Neurology of eye movements 3rd edition R John Leigh and David S Zee published by Oxford University Press

Otoacoustic emissions Clinical applications Martin S Robinette and Theodore J Glatke published by Thieme

Dillon H (2001) Hearing Aids Thieme

Attention Deficit and Hyperactivity in Children and adults Pasquale J Accardo published by Marcel Dekker. INC

Text book of Pediatric Otorhinolaryngology (2 volumes) Editors: Charles D. Bluestone, Sylvan E. Stool, Cuneyt M. Alper, Ellis M. Arjmand, Margaretha L. Casselbrant, Joseph E. Dohar, Robert F. Yellon Saunders Publication, Philadelphia, 2003

Cochlear implants, principles and practices: John K. Niparko Editors: Danette K, Joyce AM, Brandy M, Published by Lippincott Williams and Wilkins 2000

Cummings Otorhinolaryngology, Head and neck surgery 4th edition volume 3 Editor: Charles W Cummings, Published by Elsevier Mosby

Recommended Journals

International Journal of audiological Medicine

International Journal of Audiology

Otology and Otoneurology

International Journal of Pediatric Otolaryngology

Cochlear Implants International

Otolaryngol Head and Neck Surgery

References

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Royal College of Physicians. Hearing and balance disorders: achieving excellence in diagnosis and management. Report of a working party. London: RCP, 2008.

iiBMJ 1997; 314: S2-7075 (Published 18 January 1997); Wendy Albuquerque and Doris-Eva Bamiou Career Focus, BMJ, 4th January 2002; <http://www.rcplondon.ac.uk/pubs/contents/3d756bbf-4d55-4e1c-9e4f-68c7481c2f5b.pdf>).

iiiBaltussen Rob,¹ Abraham Vinod J,² Priya Monica,² Achamma Balraj,² Anand Job,² Gift Norman,³ and Abraham Joseph³ Costs and health effects of screening and delivery of hearing aids in Tamil Nadu, India: an observational study. BMC Public Health 2009; 9:135

ivBess F H, Dodd-Murphy J, Parker R. Children with minimal sensorineural hearing loss-Prevalence, Educational Performance & Functional Status Ear and Hearing, 1998. 19,Pp. 339-354.

vNikam S. (Ed.): Hearing Impairment, in Kundu, C.L. (Ed.) Disability Status India 2003, New Delhi, Pp.81 - 196.

viPrevalence and Etiology of Vertigo in Adult Rural Population Raman Abrol, Vikas I, Nehru Y, Venketramana. Indian Journal of Otorhynolaryngology and Head and Neck Surgery Vol 53 No 1, January – March 2001

viihttp://www.iegindia.org/dis_ind_26.pdf date accessed 24/11/2010