CRE Status Approved

World Health Organization
Registered Event

REPORT

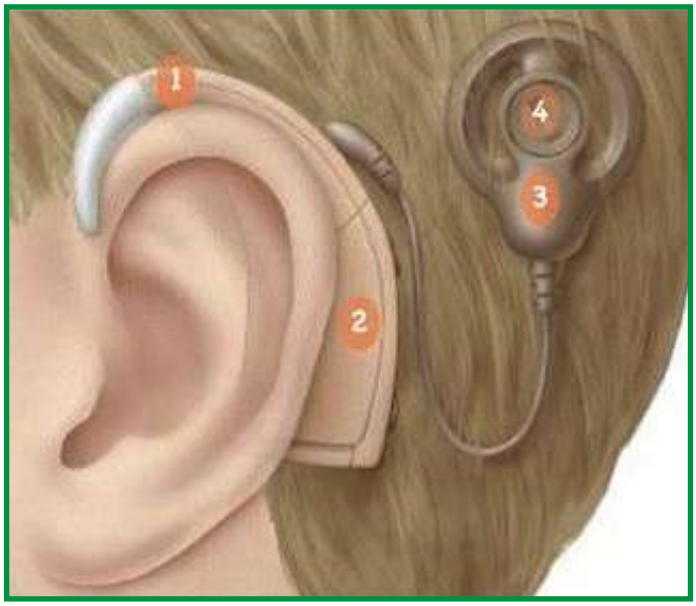
ASHTACON 2020

5th International Conference

"Cochlear Implant Instructional Course"

on the Occasion of World Hearing Day

Friday, 28th February 2020



Venue:
Tecnia Auditorium
Madhuban Chowk, Rohini, Delhi- 110085

The Ashtavakra

ASHTAVAKRA

Institute of Rehabilitation Sciences and Research

PROGRAMME SCHEDULE

9:00AM-9:30AM	Registration of Delegates
	PLENARY SESSION: - 1
Chairperson:	Mr. Vijay Kumar: Founding Head & Reader Dept. of Audiology & Speech Pathology, Amity University,Gurugram Dr. Hitesh Aggarwal: MBBS,MS-ENT, Otorhinolaryngologist, Saroj Super SpecialityHospital Mr. Ram Pravesh: Senior Audiologist & Speech language pathology Shelton ,ESA WA,USA
9:30 AM to 10:00AM	Mr. Prabakar: Audiologist Lady Harding Medical College, Delhi
10:00AM to 10:30AM	MsKeertanaHariharan; Clinical Specialist , AdvancesBionics
10:30AM to 11:00AM	Dr. Shalabh Sharma: Sr. ENT Consultant and Cochlear Implant Surgeon at Ganga Ram Hospital
11:00 AM to 11:15 AM	Tea Break
11:15 AM-12:30 PM	**INAUGURAL SESSION**
	Welcome Address — Ms Sanjana Mittal; Deputy Director, AIRSR Opening Remarks — Dr AnmolArora ; Medical Director, AIRSR Key Note Address — Dr Prof (Padamshree): J M Hans ; MBBS, MS - ENT, Diploma in Otorhinolaryngology (DLO) Address by Guest of Honor — Mr. B.P Singh: Singh speech Therapy & Hearing Aid clinic, Sector-7 Rohini Dr V.P Sah; Former Asst. Director; AJYNISHD & Audiologist & Speech Pathologist at Institute of Rehabilitation; Ghaziabad Mr J.C. Gupta; Former Asst. Director; AJYNISHD, Consultant Examiner RCI Chairman's Address — Dr R.K.Gupta, Chairman, Tecnia Group of Institutions, Delhi. Address by Chief Guest — Ms. Ira Singhal, Deputy Commissioner, North Delhi Municipal Corporation Vote of Thanks — Ms Jyoti, Faculty ASLP, AIRSR
	PLENARY SESSION: - 2
Chairperson:	Dr V.P Sah; Former Asst. Director; AJYNISHD & Audiologist & Speech Pathologist at Institute of Rehabilitation; Ghaziabad Mr J.C. Gupta; Former Asst. Director; AJYNISHD, Consultant Examiner RCI Mrs Jyoti; Assisstant professor, AIRSR
12:30PM-12:50PM	Mr. Ram Pravesh: Senior Audiologist & Speech language pathology Shelton ,ESA WA,USA
12:50 PM-01:00PM	Ms. Pamela B.Fife: Adjunct Assistant Professor, West Los Angeles Collage USA
01:00PM-01:10PM	Mr. Srivathsan Nallur : Doctor of Audiology San Bernardino California, USA Worked in HearUSA as a Audiologist currently working as a Speech language Pathologist in USA Govt Public Schools
01:10PM – 01:40PM	Ms Neevita Narayan; Chief Audiologist & Director of SPHEAR Speech & Hearing Clinic, New Delhi
01:40PM-02:30PM	Lunch
	PLENARY SESSION: - 3
Chairperson:	Mr. Vijay Kumar : Founding Head & Reader Dept. of Audiology & Speech Pathology, Amity University,Gurugram MsTanviChaudhary; Assisstant professor, AIRSR Mr. Sudhir Kumar: Assisstant Professor, AIRSR
02:30PM-03:00PM	Mr Neelesh Benet; Asst. Professor, Amity University, Gurgaon
03:00PM-03:30PM	Mr J.C. Gupta; Former Asst. Director; AJYNISHD, Consultant Examiner RCI
03:30PM -0400PM	Dr V.P Sah; Former Asst. Director; AJYNISHD & Audiologist & Speech Pathologist at Institute of Rehabilitation; Ghaziabad
04:00PM-04:30PM	Ms.ShivaniArora; Audiologist, Speech pathologist at Asha Speech & Hearing Clinic, New Delhi
04:30PM-05:00PM	Valedictory Cum Tea

CONFERENCE SECRETARIAT

Conference Patron
Dr. Ram Kailash Gupta
(Chairman)

Chief Convener
Dr. Anmol Arora
Medical Director (AIRSR)
Mob: +91-9810097591

Convener
Mrs. Sanjana Mittal
Deputy Director
Mob: +91-9899901819

Conference Coordinators:
Stall Booking : Ms. Tanvi Chaudhary (+91-9911848795)
Registration : Mrs. Jyoti (+91-9968303774)
Paper Submission : Mr. Sudhir Kumar (+91-7291059960)

ASHTACON 2020

5Th International Conference
Cochlear Implant Instructional Program

Friday 28th February 2020

Venue:
Tecnia Auditorium, Madhuban Chowk, Rohini, Delhi

Organised by:

ASHTAVAKRA
INSTITUTE OF REHABILITATION SCIENCES & RESEARCH

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PREFACE

Ashtavakra Institute of Rehabilitation Sciences and Research, is a premier Institute working in the field of rehabilitation and health services since last three decades. The institute is approved by Rehabilitation Council of India, a statutory body under Ministry of Social Justice and Empowerment, Govt of India, recognized from National Trust and registered under PwD (Person with Disability) Act 1995, affiliated to Guru Gobind Singh Indraprastha University Delhi.

The Institute offers Bachelor Degree in Special Education Hearing Impairment (HI), Intellectual Disabilities (ID) and Autism Spectrum Disorder (ASD). The Institute also offers Bachelor Degree in Audiology and Speech Language Pathology (ASLP). The under graduate programmes offered are Diploma (Special Education) in Autism Spectrum Disorder, Cerebral Palsy, Hearing Impairment, Deafblindness, Intellectual Disabilities and Visual Impairment. The institute's barrier free infrastructure provides access to all and ensures value based quality education, training, research & consultancy, in the field of rehabilitation.

To further upgrade the knowledge of professionals in special education and rehabilitation, it conducted **ASHTACON 2020, 5Th International Conference - Cochlear Implant Instructional Program** on Friday 28th February 2020 at Tecnia Auditorium, Madhuban Chowk, Rohini, Delhi.

The conference provided an appropriate platform to all academicians, intellectuals, researchers and scientists for capturing & sharing expertise on Cochlear Implant .

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CONTENTS

Dr. Ram Kailash Gupta
Chairman

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TECNIA GROUP OF INSTITUTIONS
PSP Institutional Area, Madhuban Chowk
Rohini, Delhi-110 085
Ph.: 011-27555121-24
Fax: 011-27555120

MESSAGE

It is my pleasant privilege to be a part of **ASHTACON 2020, 5Th International Conference - Cochlear Implant Instructional Program** on **Friday 28th February 2020** at Tecnia Auditorium of Ashtavakra Institute of Rehabilitation Sciences & Research. Tecnia Group of Institutes are highly committed to excellence in education and bring in a close association between Business, Education and Society.

Differently challenged segment of our society, which is very large in size and beseeched with multi-dimensional problem is highly neglected sector. This segment needs special attention from the society, planners and various governments world over. Basic requirement is to empower these individuals towards self sustenance, which cannot be possible; unless capability build up is ensured through special means. Towards achieving this objective, huge forces of specially trained human resources are required. Towards this need, even Government of India has taken various initiatives. To make a beginning, first need is to have reliable data on number of citizens afflicted with different challenges. Census-2014 was the first effort to consolidate this information on, country wide basis.

Tecnia group is providing professional training in different disciplines to large number of students, who can in turn facilitate better utilization of various faculties by differently challenged individuals and help them in improvement of their productivity and also improve their quality of life. We have set a mission to establish a global university, which provide special training for the professionals, who are engaged in the management of differently challenged people.

I extend my congratulations to Ashtavakra Institute of Rehabilitation Sciences & Research on successful conduct of this conference and I am very sure that conclusions drawn out after the conference would be highly beneficial for all the spectrums of the society viz. planners, implementers and various beneficiaries from the differently challenged communities.

Dr. R. K. Gupta
Chairman
Tecnia Group of Institutes

Dr Anmol Arora
Medical Director

Ashtavakra Institute of Rehabilitation Sciences & Research
PSP Institutional Area, Madhuban Chowk
Rohini, Delhi-110 085

Message

We live in an enlightened world of knowledge, where each and everyone is Special. Everyone has the Right to light their Future Bright. As the sun doesn't differentiate anyone in sharing the ray of Light, so do we.

India is one of the few countries in the world that is blessed with rich cultural heritage, one of the oldest human civilizations, and highly hard working pool of young people seeking new knowledge and education to raise India's stature to the top three economies in the world. This requires the development and proliferation of quality higher educational systems in India.

Tecnia Group of Institutes has always been alive to the academic needs of the country, and has provided a visionary diversification in innovative education with global paradigms. The establishment of Ashtavakra reflects a positive strides in this direction aimed at producing quality rehabilitation professional capable of strengthening and broadening the base of rehabilitation education in India .

At Ashtavakra the guiding vision and mission is to pursue excellence constantly in all its endeavors while providing world class education to its students and producing rehabilitation professionals who can serve to reduce the mismatch between the availability and demand for skilled human resourses.

Ashtavakra in the short span has stirred up a new awakening in the field of rehabilitation and are being witnessed as a array of progress in the areas of rehabilitation, which have a direct bearing on the spectacular development in Rehabilitation field.

The various programmes offered at Institute are designed to be a gateway to achieve success and overcome global scarcity of skilled and trained human resource in field of Rehabilitation. However we strive towards making learning a continuous which helps generate fresh idea and exudes enthusiasm. Besides latest academic inputs, the students are also given full fledged clinical exposure through various projects, visits & guest lectures and this keep them in sync with the practicalities of the world. All this is done in a congenial atmosphere which accelerates the student's growth process and paves the way for them to become skilled professionals .

It provides friendly and inviting atmosphere in the classroom where students are comfortable in sharing their thoughts, opinions, and questions with the class teacher as well as among themselves. Faculty fosters the interdisciplinary approach to teaching and learning in the class room and prepares students for future challenges and aims to unleash the hidden talent and develop the full potential of the Special.

In order to achieve our goal of spreading the ray of Hope and Happiness, we have five specialized wings.

1. The Ashtavakra School
2. Ashtavakra Institute of Rehabilitation Sciences & Research
3. Ashtavakra Vocational Institute
4. Ashtavakra India Foundation
5. Ashtavakra Rehabilitation Centre

Indeed a fascinating world! Thats the world of Ashtavakra an intersection where legacy, knowledge, experience and innovation come together to draw a blueprint of a world more cohesive in terms of understanding past and future knowledge, frontiers explored and unexplored, opportunities seized and invented for rehabilitation .

Dr Anmol Arora
Medical Director

NORTH DELHI MUNICIPAL CORPORATION
OFFICE OF THE DEPUTY COMMISSIONER
KESHAV PURAM ZONE

IRA SINGHAL, IAS
DY. COMMISSIONER (KPZ)

No. 453/DC/KPZ/2020
Dated: 26.02.2020

Message

I am happy to note that Ashtavakra Institute of Rehabilitation Sciences & Research had organized a one day 5th International Conference on Cochlear Implant Instructional Program on 28th February 2020 at Tecnia Auditorium, Madhuban Chowk, Rohini, Delhi successfully.

I wish entire team of Ashtavakra Institute of Rehabilitation Sciences & Research all success in their future endeavors and pray for bright future.

Yours sincerely,

(IRA SINGHAL), IAS
Deputy Commissioner
Keshav Puram Zone
North Delhi Municipal Corporation

- **All India Rank - 1 UPSC Civil Services Examination 2014**
- **Brand Ambassador, Ministry of Social Justice & Empowerment, Government of India**
- **Brand Ambassador, Ministry of Women & Child Development, Government of India**
- **Brand Ambassador, Niti Ayog, Government of India**
- **Member, National Panel for Accessibility, Election Commission of India**
- **President's Gold Medal, IAS Training**
- **India Today Woman of the Year, 2015**
- **Limca Book Record Holder**

MESSAGE

The National Trust is very glad to know that Ashtavakra Institute of Rehabilitation Sciences and Research is organizing International conference on Cochlear Implant (An Instructional Program on 28th Feb 2020 along with Ability Expo).

I am confident that the proposed International Conference will be beneficial for betterment of quality of the Persons with Disabilities.

Our good wishes for successful implementation of the programme.

(Navnit Kumar)
Deputy Director
27/2/20

ASHTACON 2020

5Th International Conference

Cochlear Implant Instructional Program

Friday 28th February 2020

(From Left to Right), Dr. Amjad Hussain, Principal, AIRSR; Dr. Anmol Arora, Medical Director, AIRSR; Dr. R. K. Gupta, Chairman, Tecnia Group of Institutions; Mr. Vijay Kumar, Founder & HOD, ASLP Dept, Amity University, Gurugram; Mr. Ram Pravesh Kumar, Senior Audiologist & Speech-Language Pathologist Shelton, ESA, WA, USA, Director, Rampo Clinic, Dwarka; Mr J C Gupta, Former Assistant Director, AYJNISHH, NRC; Dr Shalabh Sharma, MS ENT, Sir Ganga Ram Hospital, Delhi, Dr. Prof Padmashree J M Hans, MBBS, MS, ENT, Centre for ENT Hearing Care & Vertigo, Delhi, Mrs. (Dr) Hans, Ms. Sanjana Mittal, Deputy Director, AIRSR, Mr. B P Singh, Director, Singh Speech & Hearing Clinic, Rohini, Dr V P Sah, Former Assistant Director, AYJNIHH, NRC

Objectives of the Conference:

- To encourage scientific study of the processes involved in cochlear implant.
- To foster improvement of therapeutic procedures.
- To stimulate exchange of information among professionals that engaged and disseminate such information
- To facilitate research in the field of cochlear implant and guiding such research.

On 28th February 2020 evidenced the accomplishment of 5th International Conference organized by department of Speech & Hearing, Ashtavakra Institute of Rehabilitation Science & Research on the topic "Cochlear Implant Instructional Course" at Tecnia Auditorium. This 5th International Conference provided an appropriate platform to all academicians, intellectuals, researchers, professionals etc. for capturing and sharing expertise on the concept of Cochlear Implant. They had a discussion on Cochlear implant candidacy, surgical aspects, therapeutic procedures, desired outcome & quality of life in CI recipients. Apart from this there was focus on available Cochlear implant processors and current available technologies to improve speech performance in CI recipients. The conference provided a learning platform to all participants (professional delegates as well as student delegates) across rehabilitation and disabilities. There was also a discussion on educational modification & academic struggles among CI users. Abilities Expo were showcased by exhibiters .

Traditional welcome of Chief Guest Dr. Prof Padmashree J M Hans

Registration Desk

Exhibitors at Abilities Expo

Ms. Tanvi Chaudhary (Assistant Professor, AIRSR)
Hosting the Conference

The conference was initiated at 9AM with Tilak Ceremony. It was hosted by Ms.Tanvi Chaudhary, who began with briefing out the achievements of AIRSR. Then the event proceeded with Plenary Sessions.

Plenary Session 1

For Plenary Session 1, Speakers were Mr. Prabhakar Upadhyay, Ms. Keerthana Hariharan and Dr. Shalabh Sharma. The session was chaired by Mr. Vijay Kumar, Mr. Ram Pravesh and Dr. Hitesh Aggarwal

Felicitation of Mr. Ram Pravesh: Senior Audiologist & Speech language pathology Shelton, ESA WA,USA by Dr. R.K. Gupta and Dr. Anmol Arora, Medical Director, AIRSR

Felicitation of Mr. Vijay Kumar : Founding Head & Reader
Amity University, Gurugram

Felicitation of Dr. Hitesh Aggarwal
(Otorhinolaryngologist, Saroj Super Specialty Hospital, Delhi)

Mr. Prabhakar Upadhyay, Audiologist and Speech-language pathologist delivered lecture on " Pre CI Candidacy Assessment" and highlighted the importance of audiological and speech assessment. He also discussed on modified CI candidacy criteria over period and gave insight for early assessment - early implantation.

Mr. Prabhakar Upadhyaya, Audiologist & Speech- Pathologist, LHMC, Delhi delivering lecture

Ms. KeerthanaHariharan, Clinical Audiologist Language Advanced Bionics (India) delivering her lecture

Dr. Shalabh Sharma, MS ENT, Sir Ganga Ram Hospital, Delhi delivering his talk

Ms. Keerthana Hariharan, Clinical Audiologist at Advanced Bionic (India) delivered lecture on "Pre-implant electrically stimulated tests, electrodes and processors available for different population, speech coding strategies". She discussed about current available technologies and recent development in Advanced Bionic (Cochlear Implant Manufacturer Company).

Dr. Shalabh Sharma, MS ENT, Sir Ganga Ram Hospital, Delhi delivered lecture on "Surgical aspects in CI, challenges and How Radiology influences decision making". Dr. Sharma had gave excellent presentation on above mentioned topic with the use of surgical videos and powerpoint presentation.

Inaugural Session

The 5th International Conference was inaugurated by Chief Guest Dr. Prof. Padmashree awardee J M Hans along, our guest of honors Dr V P Sah Former Asst. Director, AIJHH, NRC, Mr. J C Gupta, Former Asst. Director, AIJHH, NRC and Mr. B.P Singh.The lamp-lighting session was done by our eminent chief guest, guest of Honors along with Dr. R. K. Gupta, Chairman Tecnia Group of Institution, Dr.AnmolArora, Medical Director, AIRSR Rohini, Delhi, Ms. Sanjana Mittal, Deputy Director, AIRSR, Rohini, Delhi. On this occasion, all guests of honors motivated and wished us for the conference.

Lamp lightening by Chief Guest by Dr J M Hans

Honorable Guests of HONORS:(From L to R)-Dr V.P Sah; Mrs.Charu Hans (w/o Dr. J.M Hans); Dr Prof (Padamshree): J M Hans; Mr J.C. Gupta

Opening Remarks by Dr Anmol Arora, Medical Director, AIRSR

Welcome Address by Ms Sanjana Mittal, Deputy Director, AIRSR

The Welcome address was given by Mrs.Sanjana Mittal, which was followed by the opening remarks by Dr. Anmol Arora, Medical Director, AIRSR. Ms.Ira Singhal, our second chief guest couldn't join us for the event though she sent her wishes through pre-recorded video.

Dr. Prof.Padmashree J M Hans interacted with audiences and read key notes. He highlighted the importance of audiologist & speech-language pathologist in the rehabilitation of CI recipients. He also shared his gained experience of over thousands of cochlear implant surgery. In last of inaugural session, Dr. R.K. Gupta, Chairman Tecnia Group of Institutions congratulated the staff and faculty of AIRSR for their efforts in organising the International conference. Ms Jyoti, faculty of ASLP department, AIRSR delivered vote of thanks.

Address by chief guest Ms. Ira Singal, Deputy Commissioner, North Delhi Municipal Corporation

Address by Dr R.K. Gupta, Chairman, Tecnia Group of Institutions

Keynote Address by Chief Guest Dr. Prof. J M Hans

Ms Jyoti, Faculty, ASLP department, AIRSR delivering Vote of Thanks

Plenary Session 2

For Plenary Session 2, Speakers were Ms. Neevita Narayan, Mr. Ram Pravesh, Ms. Pamela B. Fife and Mr. Srivathsan Nallur. The session was chaired Dr. V P Sah, Mr. J C Gupta and Mrs. Jyoti (Faculty, AIRSR)

Felicitation of Dr. V P Sah, Former Assistant Director, AYJNIHH, NRC by Dr. R.K. Gupta and Dr. Anmol Arora, Medical Director, AIRSR

Felicitation of Mr. J. C. Gupta, Former Assistant Director, AYJNISHH, NRC by Dr. R.K. Gupta and Dr. Anmol Arora, Medical Director, AIRSR

Chief Guest, Dr. Prof J M Hans and Dr. Anmol Arora Felicitating Mrs. Jyoti, Faculty, AIRSR

Ms. Neevita Narayan addressing the delegates

Mr. Ram Pravesh, Senior Audiologist & Speech language pathology Shelton ,ESA WA,USA , delivered a lecture on "Genetics in CI recipients ", he threw light on importance of genetic correlates associated with loss of hearing. Then there was a skype sessions by Ms. Pamela B. Fife and Mr. Srivathsan Nallur on the topics effect of bilingualism and music perception in CI recipients respectively.

Ms. Neevita Narayan, Chief Audiologist & Founder, SpHear speech and Hearing Clinic, Delhi delivered her lecture on "Switch on of device, generation of map (intra and post-op test), parameters of mapping and troubleshooting of device". She highlighted on importance of mapping and discussed audiologist's role in operation theatre.

Mr. Ram Pravesh senior Audiologist & Speech-Language Pathologist Shelton, ESA, WA, USA presenting his views

Ms. Pamela B. Fife: Adjunct Assistant Professor,
West Los Angeles Collage, USA

Mr. Srivathsan Nallur :Doctor of Audiology San Bernardino
California, USA working as a Speech language Pathologist in USA

Participants attending the International Conference

Plenary Session 3

For Plenary Session 3, the Speakers were Dr. Vakil Prasad Sah, Mr J.C. Gupta, Mr Neelesh Benet and Ms. Shivani Arora (Audiologist, Speech pathologist at Asha Speech & Hearing Clinic, New Delhi). The session was chaired by Mr. Vijay Kumar, MsTanvi Chaudhary and Mr. Sudhir Kumar.

Felicitation of Mr. Vijay Kumar

Felicitation of Mr. Sudhir Kumar: Faculty, AIRSR

Mr. Neelesh Benet, Asst. Professor, BASLP Dept, Amity University delivered talk on "Rehabilitation of CI recipients & follow up" and highlighted on importance of role of SLPs in management of CI children and discussed various therapeutic techniques.

Dr. Vakil Prasad Sah, Former Asst. Director (AYJNISHD, Delhi) delivered a very informative lecture on "Role of Central/StateGovt (schemes, funding option for CI and Disability certificate)". He gave insight and hierarchy of government schemes, different funding schemes for parents & also discussed benefits of disability certificate.

Felicitation of Ms Tanvi Chaudhary, Faculty, AIRSR

Neelesh Benenet, Asst Prof, Amity University, delivering his talk

Dr V P Sah, Former Assistant Director, AYJNIHH, NRC delivering his lecture

Mr. J. C. Gupta, Former Assistant Director, AYJNISHH, NRC delivering his lecture

Ms. Shivani Arora during her lecture

Mr. J C Gupta, Former Asst. Director (AYJNISHD, Delhi) discussed about "Academic Struggle & educational modification for CI users" and highlights the importance of mainstream education for CI recipients. Ms. ShivaniArora, senior audiologist & Speech therapist, Asha Speech & Hearing Clinic, Delhi; added on valuable information on "Quality of life and challenges of CI recipients". She had given insight of bimodal versus bilateral CI benefits.

At Last, Mr. Sudhir Kumar, Faculty of ASLP department AIRSR &CRE Programme Coordinator delivered the "Vote of Thanks" to all resource persons, professional and students. The Tecnia Auditorium witnessed the remarkable event in the form International Conference and at the end everybody stood up for national anthem.

Vote of Thanks given by Mr. Sudhir Kumar

National anthem

Educational modification and academics struggles in individuals with CI recipients

Mr J C Gupta
Retd. Assistant Director, AYJHISHD Noida
Consultant Examination, RCI New Delhi

CHILD

- When planning for a child with a cochlear Implant (CI) you should consider the child's age at implantation.
- You might have a young child who received their CI at the youngest (i.e;12 months of age) or even younger.
- Maybe you have a student who received their CI when they were older and already had developed spoken language.
- Perhaps you are going to be serving a student who received their CI when they have additional learning challenges.
- Another scenario might be a student who obtained their CI young and developed a learning disability that you might not have been aware of.
- We need to be cognizant of all possible scenarios when we meet a child with a CI.
- Also, we need to recognize the various hearing loss configurations prior to receiving an implant and varied types of CIs now used with children (i.e., hybrid CIs). The outcomes for these children will be different.

Environment

- Some children have been placed in programs where they are solely using spoken language.
- Perhaps some have been using sign language prior to receiving an implant and as they transition, some may continue to use sign language.
- There will be children using both Sign Language and spoken language from the start and continue to use both post implantation.
- The audiologist should consider the educational and linguistic environment the child is in.
- If a child has a secondary language in the home, what are the recommendations and expected outcomes?
- Children with severe to profound hearing loss who receive cochlear implants have an opportunity to develop the auditory skills that will assist them in lifelong learning.
- Although the auditory access provided by a cochlear implant can make this process easier, there remain a number of challenges that face a child with an implant, especially in the educational setting.
- Children with implants will still encounter acoustic challenges, academic challenges, attention challenges, associative challenges, and adjustment challenges.
- The knowledgeable speech and hearing professional who is aware of the potential of the implant while at the same time is cognizant of possible barriers to a child's success in school, will assist the child is using the device to receive maximal benefit.
- At day care centres and schools, young children with CIs face a variety of acoustical challenges.
- Aspects such as classroom size, number of students, and distance to the teacher can affect classroom acoustics to their disadvantage (Chute & Nevins, 2003; Crandell & Smaldino, 2000; Neuman, Wroblewski, Hajicek, & Rubinstein, 2012; Shield & Dockrell, 2003).
- Although mainstream classrooms often do not cater well to their needs (Neuman et al., 2012), more and more CI users are being placed in mainstream education (De Raeve & Lichtert, 2012; Geers & Brenner, 2003).

What are the disadvantages and risks of cochlear implants?

- Cochlear implant surgery is very safe, but any operation comes with risks. Problems can include bleeding, infections, and side effects from the medicine that sends you to sleep during the procedure. Other possible complications include:
- A nerve injury that changes your sense of taste
- Nerve damage that causes weakness or paralysis in your face
- Dizziness or balance problems
- Loss of the hearing you have left
- Ringing in your ears, called tinnitus
- Leaks of the fluid around the brain
- The device doesn't work or gets infected, which may mean you'll have to remove and replace the implant.
- Meningitis, an infection of the membranes around the brain. It's a rare but serious complication. Children and people with abnormally formed inner ears seem to be at higher risk. The FDA and CDC recommend vaccines for anyone who gets a cochlear implant to lower their risk for the disease.

What can happen if the cochlear implants get wet?

- Some parts of the device can get damaged if they get wet.
- You need to take off the speech processor before you bathe, shower, or swim. You also can cover that part with a waterproof case or choose a waterproof cochlear implant processor.
- Rarely, the implant may stop working, and you would need surgery to fix the problem.

Equipment and Technology

- Address questions such as:
- Is the acoustic environment appropriate for a student with a cochlear implant? (Refer to accommodations appendix)
- Are there appropriate hearing assistive technology systems (HATS) available and supported?
- Are there staff member identified, trained, and responsible for daily troubleshooting of the cochlear implant and associated HATS to confirm their proper functioning?
- Is there a mechanism for ongoing home-school collaboration related to the cochlear implant?

Other Integral Considerations

- Lastly, there are other considerations related to social emotional development that are provided. Questions such as the following are addressed:
- Does the program provide an appropriate peer group and opportunities for social interactions?
- Does the program have a mechanism in place to help the student build a positive self-image as a child who is deaf?
- Does the program facilitate student and/or family advocacy skills related to the use of a cochlear implant?
- Does the program facilitate student/family skills in an effort to build self-advocacy independence?
- It is important to have discussions about topics which address whether the program provides appropriate peers for the child, which is closely tied to self-esteem. This section looks at making sure the child feels comfortable about who they are as a deaf child using a CI.
- What can the program do to support self-advocacy strategies? Many times, the students themselves have to learn how to develop their independence in knowing when their CI is working and telling someone when it is not working.
- They need to feel confident and competent in doing so.

Additional Resources

- There are a few other resources I would like to bring to your attention:
- Education Planning for Students with CIs
- A Guide for Interpreters Working with Students Who Use CIs.
- Visual Language and Visual Learning (VL2).
- eBulletins: CIs: Considerations for Families (and the Professionals Who Work Alongside of Them) and CIs: Making Sure Families Are Aware of The Full Picture
- Bookmarks

Staff Training

- The section on Staff Training addresses such questions as:
- Are the services of an educational audiologist available to oversee and monitor a student's cochlear implant?
- Are supports from other specialists experienced in working with students who use cochlear implants available as recommended in a student's IFSP (Individualized Family Service Plan)/IEP/ plan?
- When listening and spoken language skill development services are recommended, does the service provider have training and experience working with students who have CIs?
- Are teachers and staff members trained in understanding the needs of students with cochlear implants and implementing recommended accommodations and strategies?
- Is there consistent collaboration among professionals involved with the student?

References

- Bavelier, D., Newport, E., & Supalla, T. (2012). Educational planning for students with cochlear implants. *Nature Reviews Neuroscience, 5*, 831-843.
- Med El: cohclear implant facts (2013, September). Retrieved from http://www.medel.com/cochlear-implants-facts/
- Nittrouer, S. (2016). Beyond early intervention: supporting children with CIs through elementary school. *Otology & Neurotology, 37*(2), e43.

Pre-implant electrically stimulated tests, electrodes and processors available for different population, speech coding strategies.

Keerthana Hariharan
Clinical Specialist-North India
Advanced Bionic (India) Pvt Ltd

Pursuing a world where everyone enjoys the delight of hearing and, therefore, lives a life without limitations.

- Innovative technologies
- Performance improvements
- Customer service

Teamwork and Technology

- Shared R&D resources
- Shared technology platform
- Common features

The Eras of Cochlear Implantation

Hearing Loss Dictates Lifestyle. "Because of hearing loss…"

- Isolation
- Effort
- Identity

Hearing Device Dictates Lifestyle. *"With my cochlear implant, I can…But, I still dont..."*

- Low expectations
- High effort
- Minimal features

Lifestyle Dictates Hearing Devices.

"The wind noise in my convertible is loud, so I stream calls to both ears."

- Raised expectations
- Recipient focus
- Flexibility without compromise

1. Hearing Preservation

2. Power Consumption Reduction

3. Size Reduction

4. Signal Processing

5. Wireless Connectivity

6. Bimodal Innovation

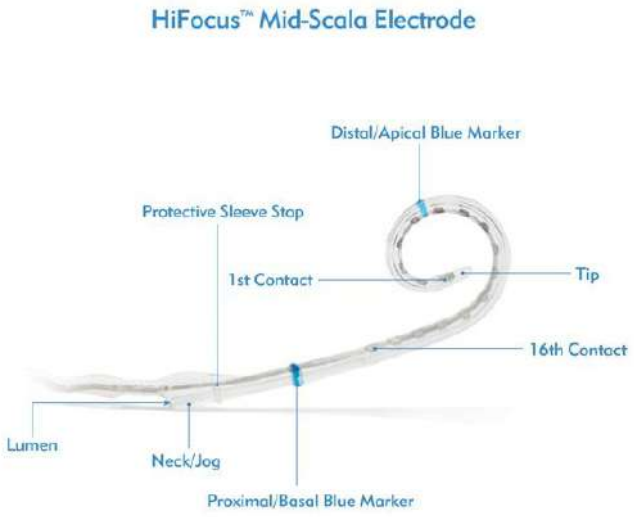
HiResolution Bionic Ear System

HiRes 90K Advantage

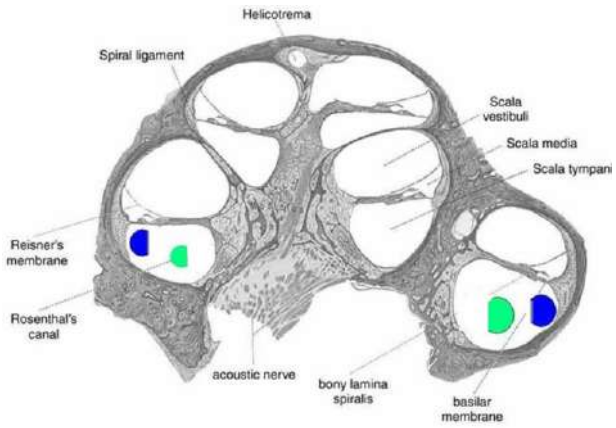
Impact resistance up to 6 Joules

The HiRes 90K® Advantage electronic board includes:

- A specific number to match the processor to a unique implant via IntelliLink
- The 16 independent current sources allowing stimulation of up to 120 stimulation sites
- Securing capacitors for optimal charge balance
- A digital processor capable of an update rate of the audio signal of 90K times per second



HiFocus Electrode Positioning



Recipients want hearing solutions that integrates seamlessly with their lifestyle and adapts to their dynamic listening needs.

AutoSound OS

AutoSound OS adapts automatically and continuously to every environment, without the need for manual processor adjustments.

Ensures the recipient always hears their best in a variety of environments.

Sound 3 Dimensional

Intensity Domain

Sound intensity 120 dB
Compression by stapedius reflex
Amplification via outer hair cells

Spectral Domain

20 dB 20Hz-20kHz
~32-35 band-pass filters
30,000 nerve fibers

Temporal Domain

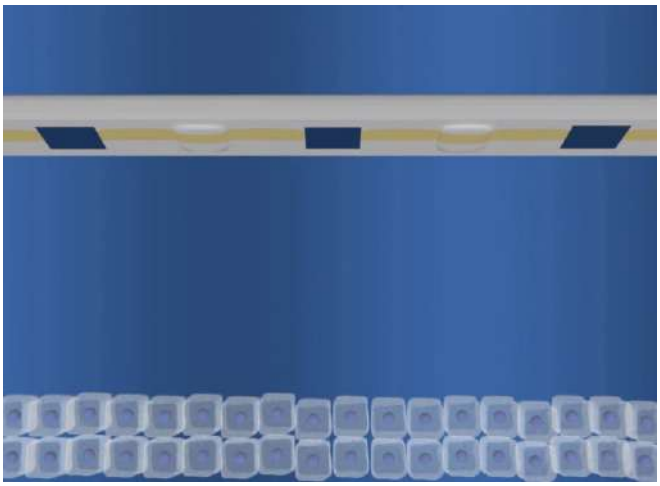
Fine speech structure
HiResolution Strategy

Conventional Spectral Resolution

16 independent output circuits

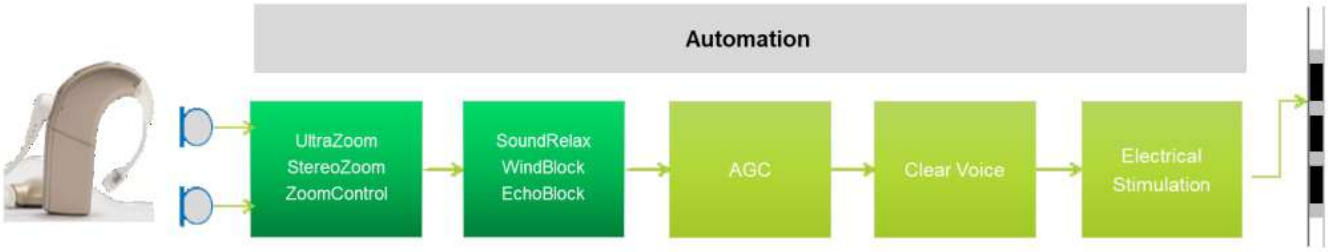
HiResolution Spectral Resolution

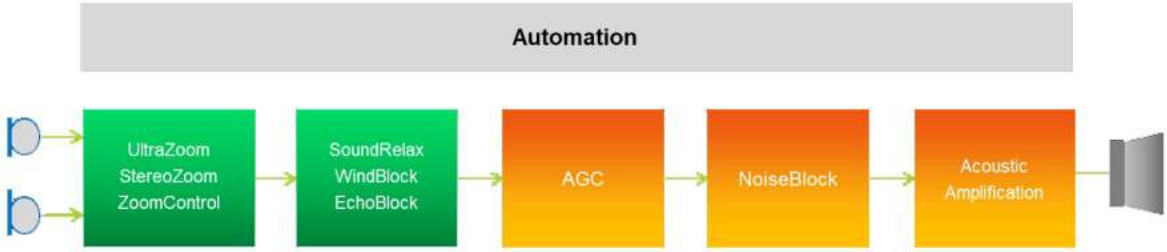
Benefits of AB's Unique Current Steering



- Current is delivered to each electrode, and the spaces between the contacts
- Stimulates intermediate nerve fibers creating additional pitch perception
- Optimal cochlear coverage and superior spectral resolution

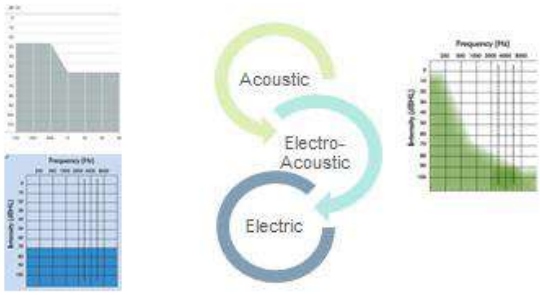
The complete range of hearing solutions





The complete range of hearing solutions

Naida CI Q90 EAS Solution



Re/Habilitation of Cochlear Implant Recipient and Follow-up

Neelesh Benet
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Re/Habilitation is a "long" process and involves a team approach. It requires commitment and belief because results cannot be seen in a short time. It often requires a lot of hard work, but the goal is easier to attain.

Re/habilitation of Cochlear Implantees

The goal of rehabilitation is to help the person integrate the implant in his/her life and obtain maximum benefit from it. In other words, learn to hear with the implant so that he/she can function as normally as is possible.

Components of Re/habilitation

- Programming the speech processor, or Mapping
- Facilitating acquisition of listening skills,
- Acquisition of language and speech
- One to one therapy
- Providing support to implantee/parents
- Support of other professionals

Mapping

"Mapping" refers to the process of programming the Speech Processor. This process is crucial to providing maximum speech information. Hence it is a key part of the re/habilitation.

Mapping is done with the computer. The basic aim of mapping or programming is to establish the useful range of electrical stimulation for each electrode channel. Two measures are obtained "T" levels or thresholds and "C" levels or maximum comfort levels. Threshold ("T") refers to the smallest amount of current that can elicit a sensation of hearing. Comfort ("C") level refers to the upper limit of stimulation that is permissible for a particular channel. Balanced "C" levels lead to a clear perception of sound.

Methods of programming

- Behavioral responses
- Electrically evoked Auditory Brain stem response
- Neural response telemetry

A. Behavioral Responses

- Techniques to establish behavioral thresholds are similar to those used for Audiometry.
- Since behavior testing takes long, a pre requisite is- adequate exposure to the task prior to implantation.

Behavioral Methods for establishing "T" levels

1. VRA- for children below- 2 yr.
2. A response is accepted if it is time locked to the stimulus.
3. Play Audiometry
4. These methods are modified slightly to establish —C‖ levels

Behavioral Indicators

- With very young children non-volitional responses offer evidence of hearing. Examples of changes in behavior are...
- Momentary stilling
- Change in facial expression
- Touching the stimulating coil.
- These responses help to condition the child later

Behavioral Methods for establishing "C" levels

- Measuring Comfort levels is easier than T levels (in some children...).
- Adults & older children can be trained to give responses to locate levels of maximum comfort.
- In young children levels are set from observation of the child.
- The procedure to establish a comfort level in older children & adults is a rating scale--
- Children (& adults) describe the sound as being too loud, comfortable or soft.
- Another method is the use of electrical stimuli to establish thresholds of reflex/as well as the EABR.

B. Electrically evoked ABR

Auditory potentials evoked by pulsatile electrical signals delivered within the cochlea have been measured. In EABR latencies are shortened by 1.5ms than acoustic ABR i.e. Ve (fifth peak in EABR) peak may be seen at 4- 4.5msec. Because it removes the delay associated with basilar membrane and hair cells, since direct stimulation of auditory nerve

C. Neural Response Telemetry

NRT is a novel method to obtain "T" levels & can be done just

after surgery. The process does not require child's co-operation. NRT utilizes the implanted electrodes not only to give a signal but also to measure the response. The specific relationship between the response & "T" levels helps to set the level.

How often is it necessary to MAP the Speech Processor?

- Weekly for first month
- monthly for first 6 months
- at least once in every 6 months
- Any time the MAP gets corrupted

When is the Speech Processor turned on?

The Speech Processor is turned on 3-4 weeks after surgery. It depends on the healing of surgery i.e. electrodes impedance. Different clients respond in unique ways at this time. Children may take longer to adapt to the new device.

Some reactions at the first switch on...

- Speech sounds like chipmunks speaking
- speech sounds like guitar strings being twanged
- speech sounds like mm mm
- I can understand Speech

How is the speech processor worn?

- A body level speech processor is worn in a pouch/pocket sewed on to the shirt in a manner similar to hearing aids or on a belt.
- A BTE is worn over the ear.
- The microphone is held on the ear by a small tube (mic lock) in young children.
- In humid areas, the speech processor is placed in a small plastic cover.

Learning to wear the Speech Processor

Some children take time to wear the speech processor, other children don't. Children must be motivated to put on the speech processor the whole day, but this requires patience. Many children (and Parents) have overcome this problem by using a Hearing Aid before implantation.

Learning to Listen

A person who is implanted has to learn to use the device. The Speech Processor provides access to all the speech sounds. For example a person with an implant will hear —eee,‖ and —sss‖ which he may not have heard with the hearing aid. But it takes a while for the brain to recognize them as such.

What are the aims of listening training?

The basic aim is to help the person recognize and understand the signals he receives from the implant. This will help him/her to communicate and in the case of young children to learn to speak. Listening training will also help him learn to speak clearly. The basic premise for any training is the belief that the child/adult will learn to listen and understand. Children take longer time

Above all --- it takes some time to make sense of what is heard.

Some techniques ….

- Consistency
- Highlighting the auditory stimulus
- Reducing visual cues
- Setting the tasks so that success is easy and skills are acquired step by step.
- Joint activities

The importance of consistency

i. Consistent input reduces confusion and increases the rate of progress. It is important to be consistent whether the patient is a child or an adult.
ii. Use of standard phrases in the beginning, reduces frustration.
iii. With young children it ensures faster language acquisition.

Stages of learning to listen

- Awareness-- First in a one to one setup then in other places
- Discrimination- he/she learns that sound are different.
- Recognition- he/she learns to recognize many sounds like his/her name.
- Comprehension-the child learns the meaning associated with the sound.

One to one approach:

- A one to one approach ensures that the person's needs are met.
- The task is set up so that he can go through the listening practice at his rate.
- The whole session is utilized to provide good communication models
- There is less chance of using signs

Support is needed from the family:

i. Knowledge about care of the speech processor
ii. Understanding of what the implant can do and how to optimize listening situations
iii. Highlighting the indices of progress
iv. Social & emotional support

Care of the Speech Processor

1. Protect from water, heat
2. Protect from static discharge, avoid synthetic clothing
3. Listening check every day

Electro Static Discharge (ESD):

ESD can corrupt a MAP. Sources of ESD are synthetic clothing, woolen pullovers, duppattas, sarees, plastic mosquito nets, Plastic/fiber glass slides, Computer screens etc. Grounding oneself on metal prevents ESD

What Parents Should Do everyday

i. Do the Ling 7 sound test every morning and if possible in the afternoon. The sounds are /a//u/,/i/,/m/,/s/,/sh/&,/ow/.
ii. Replace batteries regularly
iii. Learn basic trouble shooting
iv. Be alert to any differences in child's behavior.

How is listening practice begun?

First step is to draw attention to all the sounds in the environment. For e.g. "Listen! I heard the bell". This must be done every single time (consistency). Games to highlight presence or absence of sounds like Stop/Go, musical chairs etc. Over time this will carry over to real life.

Next step is to draw attention to differences in sound. Imitation is an easy method to use with young children. Imitation of tonal changes in voice, and any other differences are taught.

The final step is reached by associating spoken speech with meaning. All conversations help to achieve this goal. Techniques like repetition e.g. ―up up up‖, use of hand cue for key words are used.

- Simultaneously, sentences used every day are practiced.
- Story telling is a useful & enjoyable method.
- Reading helps with older children.

Factors which promote success with an implant:

I. Shorter period of deafness prior to implant
II. Number of functioning nerve fibers
III. Environment that promotes the development of listening skills
IV. A family that is supportive, committed and motivated

Switch on of device, generation of map (intra and post-op test), parameters of mapping and troubleshooting of device.

Switch on of device, generation of map (intra and post-op test), parameters of mapping and troubleshooting of device

Neevita Narayan
Director & Audiologist
Speech & Hearing Clinic Pvt.Ltd

Mapping

"Mapping" is the term given to the process of measuring the amount of electrical current delivered to the cochlea by the implant. It is the process that ensures the patient receives comfortable and useful auditory percepts.

Setting parameters

- Selection of Processing strategy, current flow modes & amount of current on each channel
  - Optimization of the electrical Signal according to the recipient's needs.
  - Optimize the performance/benefit by manipulating various software parameters
- Ensuring that soft sounds should be audible
- Mapping does not by itself result in good listening

Post-Surgery: Fitting the externals

Switch on

- About two-three weeks following surgery the implantee will return to the clinic to have the external parts of the device fitted
- This first fitting is called the 'switch on' or 'tune up' of the device

Processing Strategies

- Processing strategies determines the method in which the sound is coded.
- The manner in which each spectral cue is electrically coded
- The electrode to which a spectral cue is allocated.
- The dynamic range within which each signal is to be coded.
- The manner in which current will flow from an active to a reference electrode.

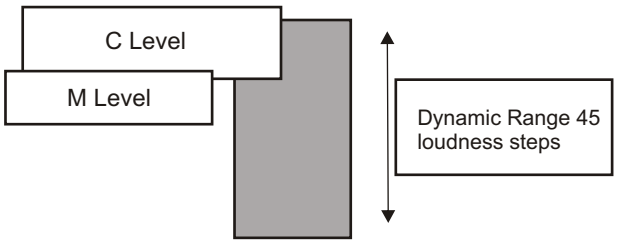
Setting up for mapping

- Medical considerations:
- post-operative radiology
- Surgical report
- Wound healing
- Technical set-up:
  C level Dynamic Range 45 loudness steps M level
- Check and connect processor and headset.
- Set-up computer hardware, processor interface and programming software.

Getting Started

- Implant test (telemetry)
- Use Sound processor
- Perform at initial activation
- ECAP measurements
- Choose the speech processor
- Choose the speech coding strategy and rate

MAP Measurements



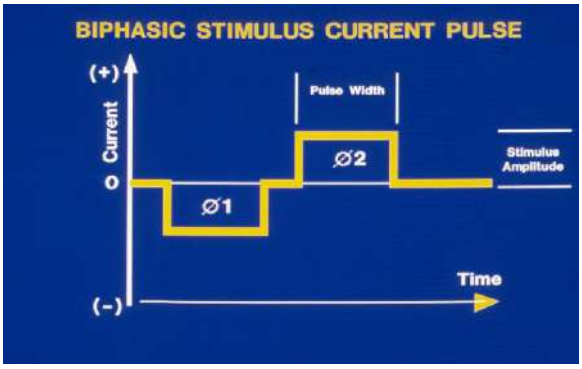
Two main measurements are required for the MAP

The difference between C-level and T-level is called the Dynamic Range.

STIMULUS PARAMETERS

- Output: charge-balanced, biphasic current pulse
- Amplitude: ~ 10 µA to ~ 1.75 mA
- Pulse width: 25 ms to 400 ms*
- Charge per phase: pulse amplitude x pulse width

Charge-balanced Pulse



Frequency cues

- Channels
- Site of stimulation important for frequency
- 22/16/12 intra-cochlear electrodes numbered.
- Active and Indifferent electrodes
- Modes of stimulation:
- Monopolar (MP)
- Bipolar (BP)
- Common Ground (CG)
- Variable

Intensity Cues

- Amount of current charge important for loudness.
- Level from 0 CL to 255 CL units.
- Level from 0 CL to 255 CL units.
- Charged balanced, biphasic pulses.

Electrodes

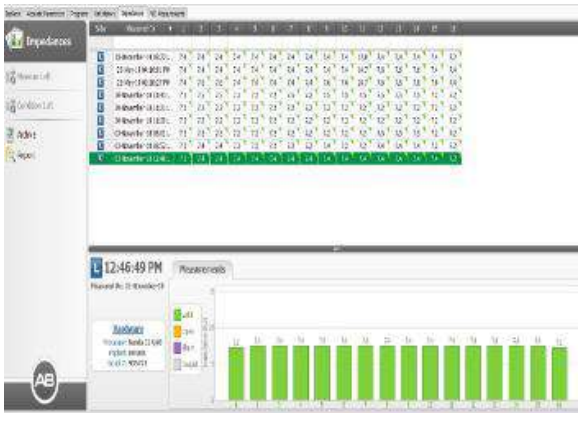
- Active Electrodes: An electrode to which the current is supplied
- Reference Electrode: The electrode through which the current flows from the active in order the complete the current flow pattern.

Setting up for mapping

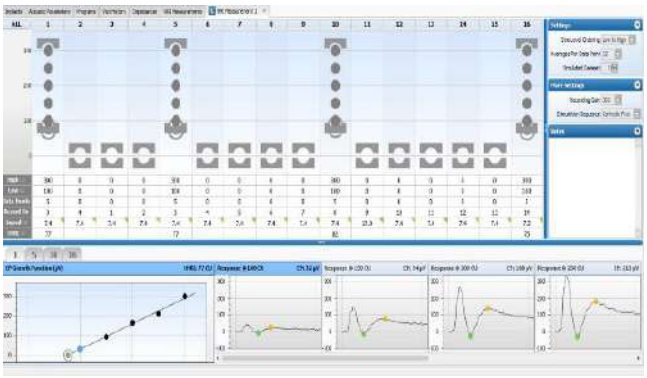
- Computer software set-up
- fill in client details
- enter stimulation and electrode parameters.
- Fitting transmitting coil
- IMPLANT TEST
- Telemetry
- ECAP measurements
- check for open circuit or short circuiting electrodes

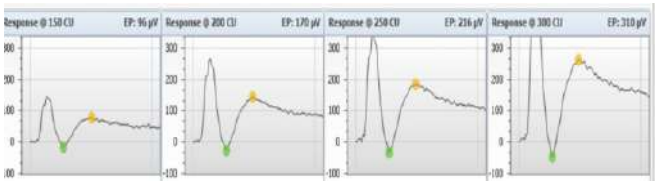
Setting up for mapping

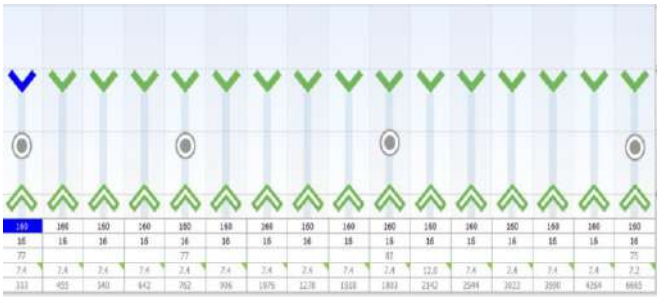
- Locate correct site for transmitting coil
- Adjust magnet strength
- 1M, 2M, 3M, 4M, 5M, 6M. Computer software set-up
- fill in client details
- enter stimulation and electrode parameters.
- Fitting transmitting coil
- IMPLANT TESTTelemetry
- ECAP measurements



- NRI measurements







The mapping procedure

- AIM: Provide stimulation with current levels that provide useful hearing
- ATTITUDE: Actual current levels are not of primary importance; rather it is the gained percept of sound.
- Continuous Map changes will not produce perfect hearing.

Making the MAP

A series of measurements is made on each electrode (psychophysics) that is then combined to produce a MAP (listening programme).

T-levels

- A T-level is defined as the lowest level at which the patient hears the stimulus every time (100% response) it is presented.
- It sets the minimum stimulation level …hearing threshold for each channel.

Setting T-levels

- A T-level is typically determined by passing threshold twice using an ascending method.
- Can interpolate between measured T-levels

- only for monopolar modes and uniform pulse widths.
- Consider T-level profile when selecting channels to measure.

T-Levels

- Threshold measurements require the patient to indicate when they can just begin to hear a sound even if it is very soft.
- This may be done by using Stimulus-Response tasks.
- Adults can raise their finger when the sound is heard.
- Children can respond through play (eg. put a peg into a board when the sound is heard).

C levels OR M levels

- A C-level is defined as the maximum stimulation level that does not produce an uncomfortably loud sensation.
- It sets the maximum stimulation - maximum comfortable level for each channel.

C-levels OR M -Levels

- Comfort Levels require the recipient to indicate when sound becomes loud but not uncomfortable.
- This is done by slowly increasing stimulation until sound becomes very loud and the recipient says STOP.
- Children can be trained to indicate when sound becomes too loud by using prompt cards or loudness scaling cards.
- In cases of very young children, experienced programmers rely on the behavioural reactions of the child to indicate where c-levels should be set.

Setting C-levels

- Instruct patient to indicate when sounds become too loud. Descendto a level that is loud but comfortable.
- If unable to reach C-levels, try wider pulse width or stimulation modes.
- Consider using the interpolation function.
- C-levels affect how speech sounds to the patient-may need to adjust loudness (C-levels) once map tested in live mode.

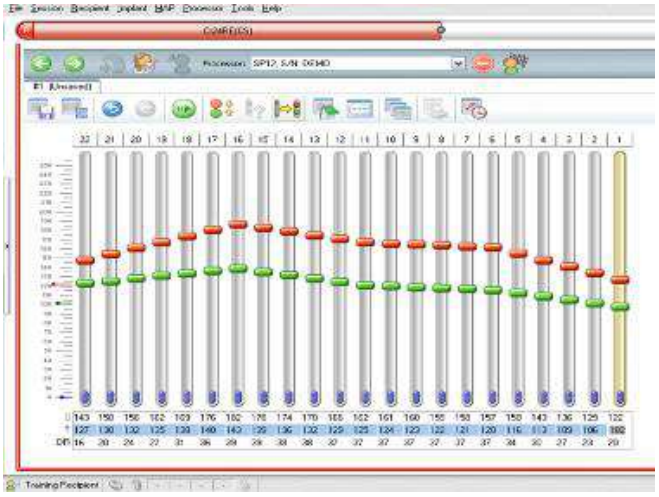
Loudness balancing

- If loudness not balanced across electrode array:
- Speech may not sound smooth to patient
- May reduce potential for receiving amplitude cues.
- Judging loudness can be a difficult task.
- Recommend checking loudness balance at C-level and 50% dynamic range.
- Sweep through 3-4 channels at a time.
- Adjust levels according to patient's report.

Creating and testing a Map

- A “MAP” is a complete set of instructions for the speech processor which includes:
- min and max .stimulation levels for each electrode.
- stimulation parameters.
- speech processing stratergy.
- It enables the processor to output data in a form which can be decoded by receiver-stimulator.

Creating and testing a Map



- Check sensitivity setting prior to testing Map.
- In live mode, the processor and implant respond to sound in the room.
- Further adjustments to the Map can be made based upon the patient's reports:
- T and C levels.
- Speech processor parameters.

Global T and C level changes

- Used to adjust loudness of speech and background noise:
- increase or decrease C levels if speech too soft or loud.
- decrease T-levels if ambient noise too loud.

Mapping considerations

- Patient not happy with the Map:
- speech is not the appropriate loudness
- speech is rough, uneven , bubbly or muffled
- speech is too high or low pitched.
- too much background noise.

A Mapping Sessions

- Ask the care giver about device use and battery consumption
- Ask questions that will help establish listening levels and any specific concerns with the current Map.
- Visually check the device.
- Check impedence of electrodes and compare them with previous recordings.
- Tune the Map, check in live mode

Checking map

- Detailed check in the live mode before finalizing the Map.
- This includes Six sound test in soft voice at 6feet in quiet room
- Informal assessment as per child’s capacity
- Important to check any behaviour indicative of discomfort.
- Map levels, number of channels ,and dynamic range are NOT accurate predictors of audibility of sounds or listening

- A Map can only improve audibility of acoustic features. It cannot solve training or listening related issues
- Ensure that a Map has actually resulted in a criterion level of auditory performance is critical.
- Aided audiogram Post Mapping is a MUST.

Mapping considerations

- Psychophysical anomalies:
- Inability to achieve (or high) T or C levels
- Variations in T and C-levels on adjacent channels
- Narrow dynamic ranges
- Stimulation that is uncomfortable
- Non-tonotopic pitch order
- Fluctuating T and C-levels.

Retrieving and testing maps

- With Mapping software, able to:
- Save maps to disk or database
- Retrieve and test previously saved maps
- Read maps from processor
- Erase and copy maps
- Print Map copies.

Other software funcitons

- Programming method:
- Behavioural
- NRT/ objective offset
- NRT/Objective preset
- Default settings/ User preferences.

When do we need to MAP?

- Initially, MAPping will be required every 1-2 weeks.
- For some children, it can take as long as 3 months to obtain a complete and stable listening programme.
- Mapping appointments can gradually be reduced to once or twice a year, once a stable MAP has been obtained.
- If a recipient notices problems with their hearing, they should return to their clinic for re-programming

Effect of Bilingualism of Language Acquisition in Cochlear Implant Recipients

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As a 40+ year ASHA certified Speech/Language Pathologist, and Audiologist, working with English speaking and bilingual children, developing their language and speech skills in rural New Mexico was my profession. Teaching communications to a culturally diverse population consisting primarily of Hispanic, Indian and Anglo populations at University of New Mexico/Los Alamos was my secondary career for 20+ years. Throughout my career, various approaches to teaching language skills were used with successful results: multimodal techniques, sign language, auditory-verbal, verbal-visual/total communication, lip reading skills, with hearing impaired children, mentally handicapped children and adults, language impaired, and speech impaired students and adults.

When asked to speak on the effect of bilingualism of language acquisition in cochlear implant recipients by one of my Clinical Fellowship Year students who I mentored and supervised in Washington State, my first thought was: "I could spend a semester in college teaching this topic!" The literature, although not as extensive as what is available dealing with cochlear implant patients alone, still is being conducted as more and more children with severe to profound sensory-neural hearing losses, who are bilingual, are turning to unilateral or bilateral cochlear implants, rather than hearing aids as the optimum treatment for their speech, language, and educational success.

The first consideration to successful language development, once familiarity with the cochlear implants has been established is to assess the recipient's listening skills. It is critical for the SLP to collaborate with the clinical audiologist, and the bilingual teacher to set realistic goals for dual language development. A functional listening assessment using tests like the Early Speech Perception Test (ESP), Test of Auditory Processing (TAPS), and the Auditory Processing Abilities Test (APAT) which are normed on children as young as 2 years old, will help to design an auditory learning program to develop listening, speaking and learning opportunities that ensure successful integration into mainstream education.

A landmark study conducted at the HOUSE Institute in Los Angeles, CA titled:

Multilingualism and Children with Cochlear Implants found these results:

- Measures of Receptive and Expressive language revealed no significant differences in scores between the oral multilingual and oral monolingual groups.
- AND statistically significant gains were demonstrated by both groups over time.
- This correlated with numerous studies of normal hearing populations where the English language skills of the bilingual participants were commensurate with those of their monolingual English speaking peers. Both languages of bilingual children with hearing loss can be supported without having adverse effects of the children's language development. (Bunta, Douglas. 2013)
- However, by contrast, multilingual children in "total communication" environments DO, in fact, appear to be at risk for slower development of functional speech perception skills due to the trilingual component. (However, socioeconomic factors MAY have negatively skewed the data for this group.)

The last factor, but by far not the least, concerns speech production accuracy and articulation. In a study by Sosa/Bunta in 2019, a comparison was conducted in monolingual and bilingual(Spanish/English speaking) children with cochlear implants to their peers with normal hearing. The results indicated children with CIs demonstrated lower accuracy and more whole-word variability than their peers with no hearing loss. Bilingual children had lower accuracy in English than in Spanish. High rates of whole word variability were prevalent in the speech of children with CIs even after many years of CI experience, and bilingual language exposure did NOT appear to negatively impact phonological development in children with CIs.

In conclusion, many factors influence the successful acquisition of language among CI recipients, whether bilingual or not: one implant vs. two, age at implantation, integration of the family, compliance with the rehabilitation program, team cooperation in planning the educational goals in the school setting…

To quote a short article in the March 2020 issue of The ASHA LEADER by Laura Sankey:

As these children develop into adulthood, what they seem to want is to understand their identity as "DEAF" individuals and to find a community of peers and role models to share their experiences. Her advice to clinicians: incorporate aspects of Deaf culture and the Deaf community into treatment sessions. Expose students to Deaf role models. "We should show our students the beauty that lies in their language, culture, and the community that surrounds them."

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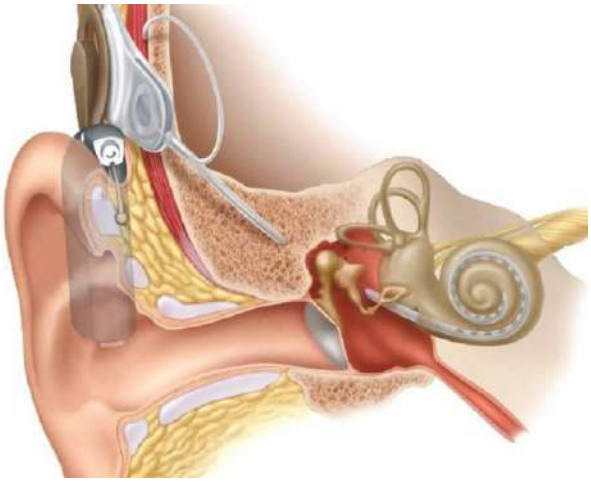
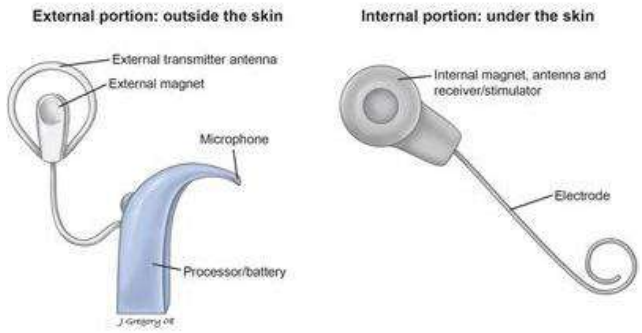
The Cochlear Implant How it works? Guide to case selection (Pre Implant Audiological & Speech Assessment)

Prabhakar Upadhyay
LHMC and Associated Hospitals,
New Delhi

What is Cochlear Implant?

An auditory sensory device represent acoustic stimuli as electrical impulses presented to the auditory nerve that can be perceived as sound bypasses the impaired cochlea and directly stimulates residual neural elements in the auditory nerve. For successful cochlear implant use, high residual neural survival is needed.





- ☐ External components consist of
- microphone : collects the sound
- sound processor: digitally analyse signal & separate into frequency bands and compressed into an electrical dynamic range
- Transmitter : sends the signal across the skin to the internal component
- power supply
- ☐ A magnet is situated in both the transmitter and receiver/stimulator so that the two components remain aligned, enabling the electrical signal to be conveyed across the skin via radio frequency.
- ☐ The internal receiver picks up the signal from the transmitter and delivers the signal to specific electrodes within the array that are arranged tonotopically

Implant Candidacy evaluation Team (Core)

- Surgeon (otologist/otolaryngologist)
- Audiologist
- Pre-implantation =>
- focus of care is determining medical and audiological suitability for cochlear implant surgery
- managing any medical conditions that may prevent surgery
- Post-implant =>
- post implant healing,
- focus shifts from primarily medical management to primarily audiological management

Implant Candidacy evaluation Team

Consultation (multiple disciplines)

dependent on many factors including the age and nature of the population

- Radiologist
- Developmental Pediatricians,
- Speech and language Pathologist,
- Evaluation of educational programs
- Psychologist- provision of family counseling
- Social Worker - guidance and support to the child and the family

Implant Candidacy evaluation Team: Role

- to determine candidacy for cochlear implantation
- to help prospective recipients make informed decisions about cochlear implant surgery and device options
- to provide post-implant device setting and monitoring

Role of Audiologist

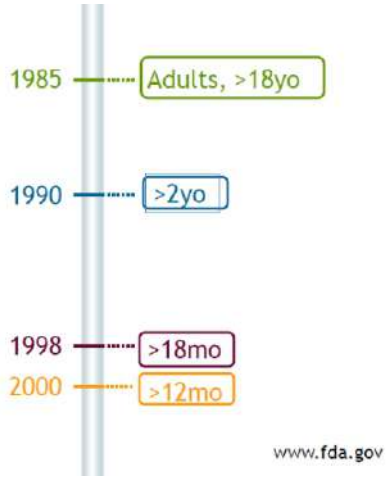
- Pre-implant assessment and determination of candidacy: audiological test battery which includes, but is not limited to, conducting assessments of auditory sensitivity, aided speech detection/reception, and spoken-word recognition
- Ongoing post-implant care : counseling, care of the device, and provide the opportunity for optimized programming

Patient management depends on sound clinical judgment involving a solid understanding of several different areas of audiology:

- audiometric testing,
- electrophysiology,
- fitting and verification of amplification,
- speech perception
- the impact of hearing loss on educational, vocational, and psychosocial outcomes, as well as speech and language skills
- pre-operative assessment of effect of patient's hearing history or radiographic findings may have on performance

Issues in Candidacy criteria

- Age => age at which to implant and ceiling
- Residual Hearing/ contralateral useable acoustic hearing
- adults who had pre-lingual onset of deafness and/or long duration of profound post-lingual deafness: demonstrable improvements in Quality of life
- Candidacy => less centered on audiometric thresholds and performance with amplification (hearing aids) has gained greater importance [Is hearing aid used optimally]
- Cochlear implants in unilateral deafness or asymmetric hearing loss where only the ear to be implanted meets cochlear implant criteria => Not specifically covered under FDA approval but being successfully done
- Inherent variability of the assessments (both threshold and speech perception measures): most routine clinical measures are known to have less than perfect test-retest reproducibility, not currently taken into account when applying them
- Evolution of Candidacy: History of FDA Approval



Evolution of Candidacy

- Ages => Prelingual > 12 months
- Speech-perception abilities => low
- Hearing aids => hearing loss cannot be adequately addressed through acoustic amplification alone
- Bilateral implantation (receipt of a cochlear implant in each ear),
- Electroacoustic cochlear implants (low frequencies transmitted via acoustic amplification and high frequencies transmitted via electrical stimulation),
- Bimodal stimulation (receipt of a cochlear implant in one ear and use of a hearing aid in the contralateral ear)

Effect of age/duration of auditory deprivation

☐ Pre-lingual:

- Following US FDA criteria, we recommend that cochlear implant can be done between age 1-17 years.
- Patients below 1 year and more than 17 years can be operated depending on case to case basis.
- After 5 years of age should be done after meticulous evaluation with multidisciplinary approach and a well-informed consent regarding outcomes.

☐ Post-lingual:

- There is no age limitation for cochlear implantation in post lingual recipients.
- The important considerations are the aetiology of hearing loss and the associated co-morbidities in the geriatric age group.

Medical evaluation determining Candidacy

- CT
- MRI

Paediatric Recipients

- Individuals with special considerations should not be excluded
- Difficult to test and confirm hearing threshold
- Auditory neuropathy spectrum disorder (ANSD)

- synaptopathy,
- neuropathy,
- dysynnchrony
- Intellectual Disabilities
- Autism spectrum disorder (ASD)
- realistic expectations should be addressed thoroughly
- confounding variables - calculated and considered

Adult Recipients

●Post-lingual

- AC thresholds octave frequencies 125 - 8000Hz and inter-octave frequencies as indicated
- Bone-conduction thresholds octave frequencies 250 - 4000Hz
- Speech perception (appropriately fit amplification)
- Each ear aided separately and binaurally (to determine the patient's best aided condition)
- If such testing indicates the patient's personal hearing aid is not suitable, an appropriate hearing aid must be selected and used for the evaluation
- performed in the sound field using recorded test materials at a presentation level of 60 dBA SPL to reduce variability

Factors Affecting Outcome of Implant

- age at onset of the hearing loss,
- stimulation of the auditory pathway prior to implantation,
- pre/postlingual deafness,
- age at implantation,
- cochlear implant experience and auditory training,
- residual hearing, spiral ganglion cell survival in auditory pathways,
- cognitive abilities,
- patient/family personality and motivation, parental involvement and commitment,
- quality of device programming,
- consistency of follow-up appointments

Surgical steps in Cochlear Implantation, challenges & How Radiology influences decision making

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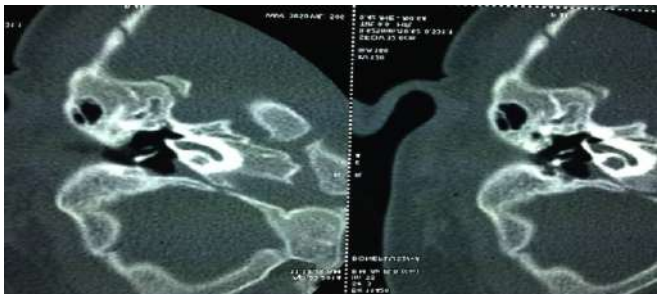
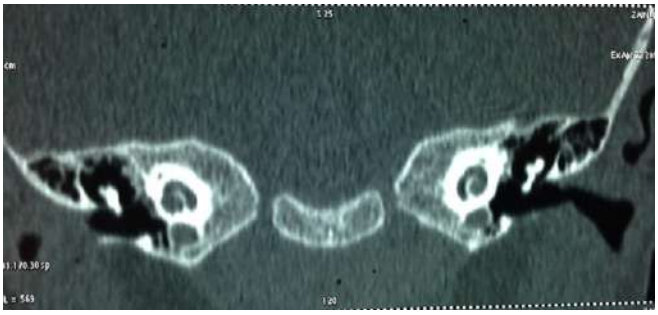
Expanding candidacy and selection criteria for cochlear implantation have increased the chances of cases with difficult anatomy with respect to surgery and outcomes….

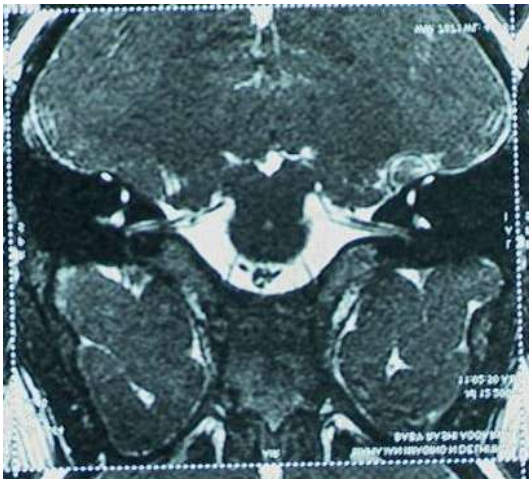
HRCT temporal bones

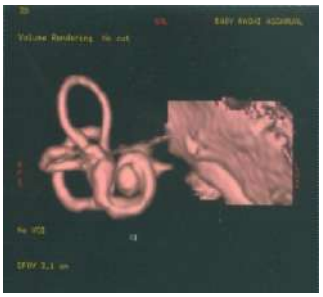


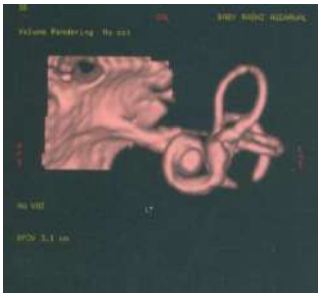
HRCT



MRI

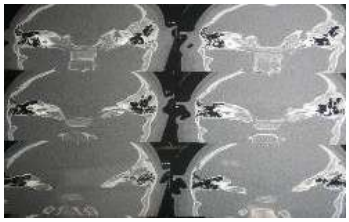


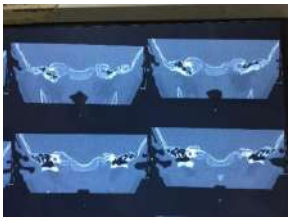




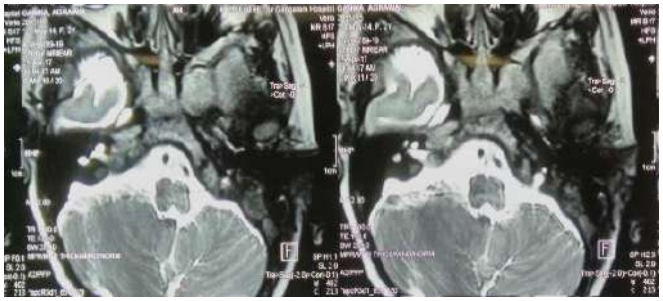
Case 1(IP-1)

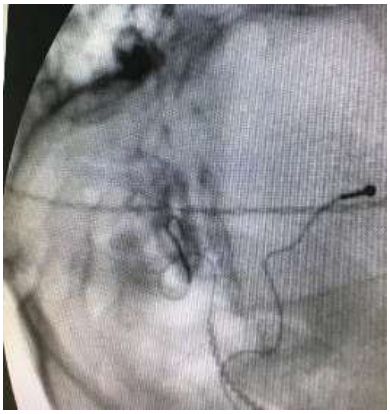
- 3 yr old female child presented with profound hearing loss and was planned for cochlear implantation
- Left cochleo-vestibular aplasia. Right cystic cochlea and dysplastic vestibule with absence of SCC (IP 1)





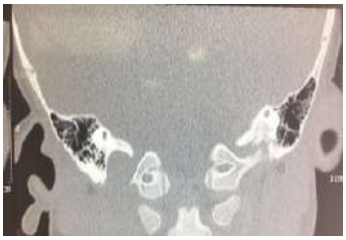
Right cystic cochlear cavity with dysplastic vestibule with absence of SCC (Incomplete partition type I), normal cranial nerve 8th and Left labyrinthine aplasia





Case 2 (Common cavity)

- 23 months old child
- MRI Brain : B/L Non visualisation of cochlea with dysmorphic cystic appearance of bilateral vestibule and SCC. Normal visualisation of the VIIIth nerve complex in CP angle and IAC.
- HRCT Temporal Bone: B/L presence of irregular cavities showing a wide communication of IAC on right side and narrowed communication with common cavity with small IAC on left side.



During surgery

- Posterior tympanotomy
- No promontorial bulge seen and no round window niche identified
- Anterior tympanotomy to inspect the middle ear
- No identifiable cochlear prominence seen
- Incus buttress drilled out and prominence of the labyrinth identified
- Labyrinth (common cavity) blue lined and straight electrode array inserted by post-box technique.

Post-Operative

What makes them difficult?

Major surgical problems that can be encountered

- Possibility of Cerebrospinal fluid (CSF) gusher and post-operative meningitis
- Facial nerve anomalies (most often due to antero-medial migration of facial nerve)
- Increased risk of perilymph fistula
- Electrode Misplacement
- Difficulty in finding cochlea itself

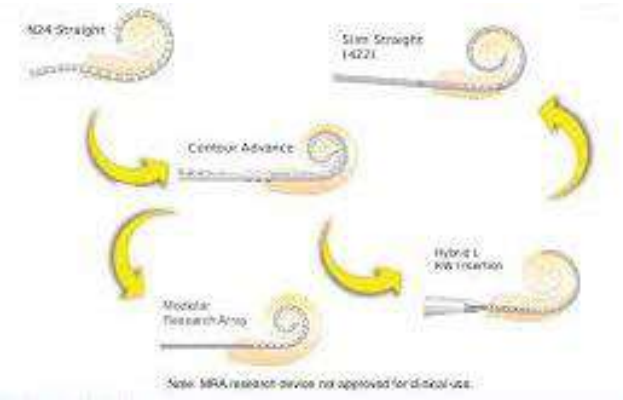
Challenges we face

- Detailed examination of the radiological scans and then appropriate classification, to decide appropriate approach and anticipate difficulties in surgery.
- Decision making for the surgical approach and the type of electrode most suitable
- Assessment of risk of complications and outcomes so as to prognosticate and counsel the family

Conclude

We should always be prepared-

- Alternative cochlear implant devices (straight electrode arrays, dual arrays, compressed arrays, etc.),



- Barring abnormal anatomy, these cases may prove more difficult for the audiologist rather than the surgeon
- Use of a facial nerve monitor & intra-op x ray/fluoroscopy is highly recommended.

Quality of life & challenges of CI recipients (Unilateral/Bilateral CI, Bimodal Hearing & ANSD)

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Innovation of Cochlear implant- is a blessing

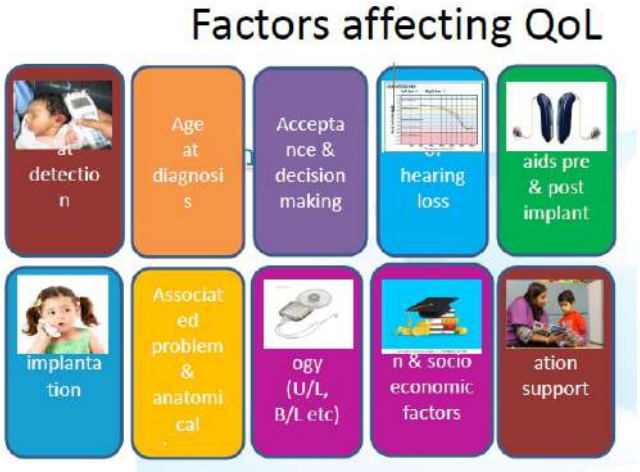
- It can be life-changing for people having a serious hearing problem.
- Cochlear implant helps to hear
- Speech at nearly normal level.
- Understanding speech without lip reading.
- Developing multi languages
- Easier to talk on the phone
- Hear the TV easily
- Music is heard well than before.
- Different types of sounds, including soft, medium, and loud ones
- Better academic performance
- Get better control on own voice

Cochlear Implant Journey- Challenges in decision making

Stages of Journey	Issues to Consider
Diagnosis	Information about services available, explaining the results, importance of early intervention
Referral	Hearing aid fitted, appropriate referral, middle ear treatment, causes & nature hearing loss
Assessments	Multi-disciplinary assessment, include expectation counselling, evaluation of associated issues if any
Shared Decision	Adult/parent/family make decision, sharing information, choice of ear etc

Cochlear Implant Journey-challenges in stable support team work

Surgery	Issues to Consider
Surgery	Experienced surgeon & rehab team, good hospital, latest technology & equipment, paediatric & anaesthetic care
Initial fitting	Latest technology & equipment's available, hearing aid use considered, initial adjustment to new sound
Rehabilitation AVT	Being persistent, learning from others, discuss, access to appropriate therapy & support
Life long support & maintenance	Support with spare part, support at school, ongoing troubleshooting, monitoring progress, latest upgrading & providing updates of technology etc.



Challenges with Unilateral, Bilateral & Bimodal CI

Binaural Hearing

- Bilateral summation, which happens when both ears hear the same sounds and therefore they send more sound information to the brain than if just one ear was receiving sound.
- Head shadow effect, which is when a hearing aid or implant prevents the head from blocking sounds from reaching the non-implanted ear.
- Squelch effect, which is when the brain gets sound information from both ears and uses this information to filter out unnecessary sounds.

Benefits of bilateral implantation

Benefits of binaural hearing

- Accurate localization, better discrimination
- Helps in balancing & performing Multitask
- Ease of listening
- Quick outcomes as compared to Unilateral or bimodal
- Binaural listening gives more confidence
- Helps reducing cognitive load
- Also gives better hearing in noise.
- One time surgery, more economical.
- One time therapy
- In any temporary eventuality like external processor faulty.

Challenges with Binaural Implantation

- Simultaneous
- Economical Pressure: Arranging funds together for two ears
- Surgical cost is double
- Audiological habilitation is double
- Spare parts cost is double
- Upgrading processor together is difficult in self-funding Indian scenario
- In cases of sequential cochlear implants asymmetries in auditory function due to long inter-implant delays
- Compromised bilateral benefits

Unilateral cochlear implant

- Cochlear implantation in one ear

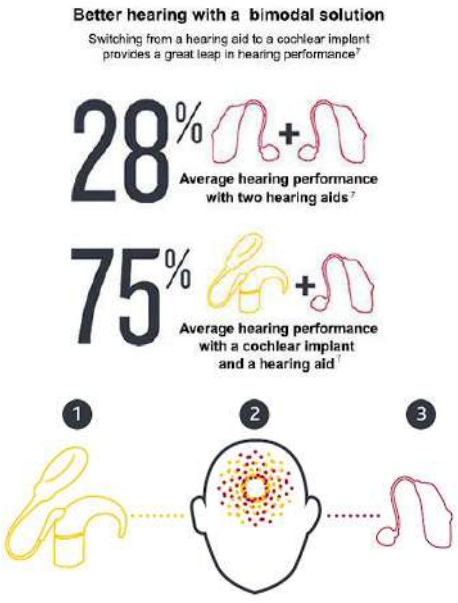
Challenges with unilateral CI

- Difficulty in Localization
- Difficulty in listening from distance
- Difficulty in noisy situation
- Difficulty in understanding speech in a group.
- Impaired cortical function in contralateral ear
- Repetitions
- Cognitive load
- Low confidence
- Emotional disturbances

Bimodal Hearing

- Bimodal hearing means using Cochlear implant in one ear and hearing aid in contralateral ear.
- Compared with monaural hearing, benefits of bimodal hearing include:

- improved speech perception in quiet
- Improved speech perception in noise,
- improved localization: Being able to tell better where sounds are coming from
- Improved music perception. (Hopyan et al 2012)



Challenges with Bimodal Hearing

- Management of these devices can be challenging in case where hearing aid and cochlear implant may be managed by different clinicians at some centres.
- Binaural integration may take time in cases of better hearing in contralateral ear.
- Denial of HA over CI (speech processing through processor)
- Our Protocol: hearing aid is fitted before implantation and use both CI & HA is encouraged from day of switch on.

Challenges with ANSD

ANSD & CI

- CI in children with ANSD has showed benefits comparable to children with profound sensorineural hearing loss.
- Open-set speech perception scores showed an overall tendency to be poorer than those seen for the implant recipients with sensorineural hearing loss. Rance and Barker (2007).
- Speech Perception score for HINT sentence increased from 4% pre implant to 42%post implant Mason et al. (2003).

Factors affecting Quality of Life post implantation

- Age at identification of Hearing loss
- Age at diagnosis
- Family acceptance & motivation, decision making
- Socio-economic factors
- Family education
- Age at implantation
- Associated problem like ASD, ADHD, syndromes, CP.
- Anatomical issues
- Choice of implant & processor
- Unilateral, bilateral (sequential or simultaneous)
- Use of hearing aids before or & after implant
- Professionals

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Music Perception in Cochlear Implant Users

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INTRODUCTION:

Music is complex and wide, including many elements variety as rhythm, melody, timbre, pitch, and harmony. It is inserted in the daily life, in the entertainment, fun and relaxation, being able to help the creativity and the expression of feelings. In previous studies, it was possible to observe that the frequency, in hours per week, of listening to music decreased after cochlear implantation, however, the music remained of great importance in the life of the patient. One of the strategies used to improve the identification of songs is the use of lane (letters and/or rhythm).

Cochlear implants aimed to provide patients with little more than awareness of environmental sounds and some cues to assist visual speech-reading, the technology has advanced rapidly. Currently, most people with modern cochlear implant systems can understand speech using the device alone, at least in favorable listening conditions.

The perception of music might be enhanced for implant recipients in the future. The most significant findings of past research are:

(1) On average, implant users perceive rhythm about as well as listeners with normal hearing.

(2) Even with technically sophisticated multiple-channel sound processors, recognition of melodies, especially without rhythmic or verbal cues, is poor, with performance at little better than chance levels for many implant users.

(3) Perception of timbre, which is usually evaluated by experimental procedures that require subjects to identify musical instrument sounds, is generally unsatisfactory.

(4) Implant users tend to rate the quality of musical sounds as less pleasant than listeners with normal hearing.

(5) Auditory training programs that have been devised specifically to provide implant users with structured musical listening experience may improve the subjective acceptability of music that is heard through prosthesis.

(6) Pitch perception might be improved by designing innovative sound processors that use both temporal and spatial patterns of electric stimulation more effectively and precisely to overcome the inherent limitations of signal coding in existing implant systems.

(7) For the growing population of implant recipients who have usable acoustic hearing, at least for low-frequency sounds, perception of music is likely to be much better with combined acoustic and electric stimulation than is typical for deaf people who rely solely on the hearing provided by their prostheses.

Enjoyment and Recognition of Music:

Musical enjoyment and listening habits vary significantly among implant users. Many implant users describe music as unpleasant or difficult to follow. Although most implant users report their daily music listening habits decline substantially following implantation, some users report they still enjoy listening music after implantation (Lassaletta, Castro et al., 2007). Surveys of cochlear implant users' music listening habits indicate that a quiet listening environment and pre-existing familiarity with the music correlate with an increased enjoyment of music. One such study correlated the amount to time spent listening to music to the subjective judgment of music as pleasant (Gfeller, Christ et al., 2000). While intriguing, it is difficult to ascertain if implant users who better perceive music tend to listen to music more frequently or if frequent musical listening practice facilitates improvements in music perception.

Effects of Training:

While the ability cochlear implant users to perceive music often correlate to levels of music exposure prior to implantation, several studies have demonstrated that training can improve music perception after implantation. One such study investigated the effects of training on six implant users on a melodic contour identification task for periods ranging from 1 week to 2 months with individual practice varying from 30 minutes to 3 hours per day. All patients showed marked improvement in the ability to recognize semitone distance and this improvement increased as the training period continued. Follow-up testing on two of the users performed at 2 months after training ceased showed a slight performance decrease compared to performance immediately following the training period but performance levels remained significantly improved over pre-training levels (Galvin, Fu, et al., 2007). In a study of training effects on timbre recognition, 12 users trained for 12 weeks while a control group received no training. Although the two groups showed similar response patterns prior to training, following the training period the

training group significantly outperformed the control group and showed a less diffuse error pattern compared to their own performance prior to training (Gfeller, Witt, et al., 2002a). The results of these and similar studies continue to demonstrate the important and beneficial effects of long-term training on cochlear implant-mediated perception of music.

Conclusion:

Music remains an extremely challenging category of auditory stimuli for implant users. While clinical investigations of cochlear implant-mediated perception of music must deconstruct music into its fundamental elements, such as melody, rhythm, and timbre, these individual aspects of music do not fully represent the complex challenges and difficulties faced by implant users while listening to music in most settings. Although cochlear implants are designed for language perception, the perception of music is now viewed as a viable possibility and is increasingly recognized as an important goal of cochlear implant and processing strategy design. Continual improvements in electrical-to-cochlear pitch mapping, pitch processing strategies, and the ability to preserve residual hearing in the implanted ears, together with an increased recognition of the importance of training should ultimately lead to major improvements in the ability of cochlear implants to convey musical information.

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Role of Central/State Government (schemes, funding option for CI and Disability certificate)

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Applicable w.e.f. 1st April, 2014, Scheme of assistance to disabled persons for purchase/fitting of aids/appliances (ADIP scheme)

NEED

- As per NSSO (2011)-there were 2.68 crore (2.21% of the total population) Persons with Disabilities (PwDs) in the country.
- About 3% of them were children below 14 years of age.
- Many of them require aids/appliances to attain capacity for self-care and independent living.
- Among all the disability, 19 % were disability in hearing (Male = 18% and Female = 20%).
- An estimated 27,000 Children are born deaf every year in India
- A large number of disabled persons are from the low income groups

AIMS AND OBJECTIVES

- To provides modern and standard aids/appliances at minimum costs
- Essential for their social, economic and vocational rehabilitation.
- To reduce the effects of disabilities.
- To enhance the economic potential of the disabled
- To improve their independent functioning

IMPLEMENTING AGENCY: eligibilities

- Societies under the Societies Registration Act, 1860.
- Registered Charitable Trusts.
- Indian Red Cross Societies and other Autonomous Bodies headed by District Collector.
- National Institutes, CRCs, RCs, DDRCs, National Trust, ALIMCO.
- National/State Handicapped Development Corporation.
- Local Bodies Zilla Parishad, Municipalities, District Autonomous Development Councils and Panchayats etc.
- Hospitals registered/recommended by State/UT/Central Govt.
- Agencies which has employed professional/technical expertise recognized by RCI.
- Agencies possessing appropriate infrastructures.
- Not involved in commercial activities.

Beneficiaries who can avail the facilities

- An Indian citizen.
- Holds 40% of Disability Certificate.
- Has monthly income from all sources not exceeding Rs. 20,000/- per month.
- Who have not received assistance during the last 3 years?
- Children below 12 years of age

Guidelines for cochlear Implantation (2014-2015)

Objective

- To provide cochlear implantation to children and support for auditory verbal habilitation to operated children.

Quantum of Assistance

- AYJNISHD recommends children eligible under the scheme
- The ceiling is of Rs. 6.00 lakh per unit.
- Ministry through AYJNISHD has identified and recognized the Institutes/Hospitals in different zones of the country for surgery.
- The cost of the surgery as per CGHS norms paid to approved/recognized hospitals.
- Post-operative auditory habilitation services is to be charged as per AYJNIHH norms or not exceeding the amount specified by CGHS norms.
- Travel/Boarding/Lodging expenses of Rs.200/- per visits may be provided during post-operative rehabilitation under the scheme for a period of one year.

Eligibility of the Beneficiaries-

A: General

- An Indian citizen.
- Holds a 40% Disablement Certificate or as defined in the PWD act.
- Has monthly income from all sources not exceeding Rs.20, 000/- per month.
- In case of dependents, the income of parents/guardians should not exceed Rs.20, 000/- per month.

B:- Audiological and Medical Criteria

- AYJNISHD and its regional centers determines the candidates for cochlear implantation on an individual basis
- Person's hearing history; cause of hearing loss, amount of

residual hearing; health status and family commitment to aural habilitation /rehabilitation are taken into consideration.

- Pre-lingual-Before acquiring speech (1 to 5 years): to achieve maximum overall benefit during critical period of age.
- Post-lingual after acquiring speech (up to 12 years): Post lingual deafness can have detrimental effect on speech and language, and overall development. These children will get maximum benefit as they were already exposed to critical period.

Pre-lingual (1 to 5 years)

- Age group of 1-5 years as on 31th December.
- The screening committee is empowered to make exceptions beyond 3 years up to 6 years of age on a case to case basis.
- Bilateral Severe-to-Profound Sensorineural Hearing loss.
- Children must be using hearing aids for about 3 to 6 months.
- Little or no benefit from conventional hearing aids either in terms of better hearing or acquisition of speech and language skills.
- No medical contradictions to surgery and or implantation. Children with abnormal cochlea/malformed cochlea are not considered for cochlear implantation.
- Free from any development delays and other sensory and oro-facial defects.
- No associated problems.
- No retro cochlea pathology (no agenesis of auditory nerve)/ central deafness.
- Children with active middle ear infection may be considered for cochlear implantation only after middle ear pathology is resolved.
- Vaccination against H influenza and Pneumococcus.
- Motivated parents to attend auditory verbal habilitation.
- Parents should be prepared to undergo a mandatory training on speech therapy and post-operative care.
- Child should not suffer from Mental Retardation/ Development delay.
- Child may need to be assessed by clinical psychologist in case of suspected abnormal psychological behavior.
- Severe-to-Profound Sensorineural Hearing Loss.
- Children must be habituated to using behind the ear hearing aids for about 3 to 6 months to assess utility of usage of hearing aids.
- Proof of having used conventional hearing aids along for sufficient time before advising cochlear implantations with details of process of speech therapy that they underwent form accredited rehabilitation personnel.
- Little or no benefit from conventional hearing aids either in terms of better hearing or acquisition of speech and language skills and comprehension of spoken language.
- Other conditions applicable for pre-lingual (1-5years) are also included.

Pre-Implant Candidacy evaluation

Audiological Investigation Protocol

- Must undergo following essential diagnostic tests at the center with qualified Audiologist/Speech Language Pathologist with Minimum MASLP qualification:
- Pure Tone Audiometry (PTA)
- Behavior Observation Audiometry (if not cooperative for PTA)
- Impedance Audiometry
- Oto-acoustic Emission
- ABR and /or ASSR
- Aided Audiogram
- Assessment of speech and language development.
- HRTC temporal bone for bony cochlea and middle ear cleft.
- 3D MRI for membranous cochlea/neural bundle and MRI brain.

C.Pre-Implant family counseling

- Candidates for cochlear implantation need to be informed of the potential risks and benefits of cochlear-implantation and the impact it may have on their life.
- The surgical procedure and its risks should be described along with a physical description and, preferable demonstration, of the internal and external portions of the device.
- The post-surgical programming and rehabilitation procedures should be charted out and informed to the parents.
- The most important aspect here is to give a realistic expectation regarding performance outcome with the implant.

D. Parent declaration

- The parent or legal guardians of the implantee to give an undertaking saying that they will undergo post-implant rehabilitation program as recommended by AYJNIHH for a minimum period of 12 months.
- The parent or legal guardians of the implantee will also give an undertaking saying that AYJNIHH and its regional centre(s) will not be held responsible for any surgical and /or post-surgical complications.

E. Procedure for selection of candidates

- Notification to be issued by AYJNIHH inviting applications from the eligibility /perspective cochlear implantee in leading newspapers and in the official website of AYJNIHH.
- A preliminary screening committee to scrutinize the received applications and refer to the nearest centers of AYJNIHH for detailed candidacy evaluations.
- The respective centers after carrying out detailed candidacy evaluation, forward to AYJNIHH, Mumbai for necessary approval.
- Only unilateral cochlear implantation -covered under this scheme.
- Reservation for SC/ST/OBC beneficiaries as per the Government norms and at least 25% of overall beneficiaries needs to be girl child.

Genetics in Cochlear Implant Receipients

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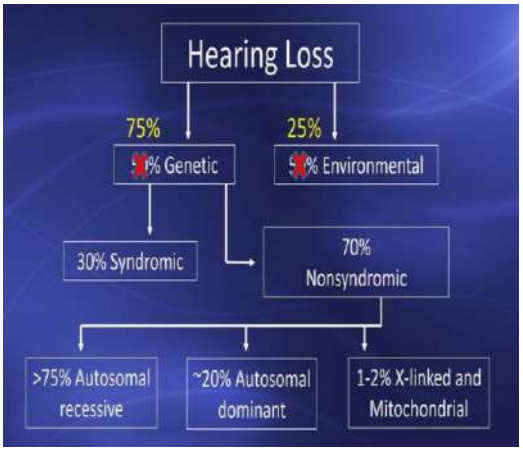


Hearing loss statistics

- 3/1000 newborn diagnosed with permanent hearing loss
- >90 % of deaf children are born to hearing parents
- ~90% of young children's knowledge is attributed to
  — incidental reception
  — of sound around them .
- One study showed 1/3 of kids with unilateral hearing loss had failed at least one grade.
- Hearing loss prevalence in the united states.
  - Age 12+ ; 1 in 8
  - age 65 to 74 ; 1in 3
  - age 75+ ; 1 in 2

Anatomy of the ear

Genetic hearing loss

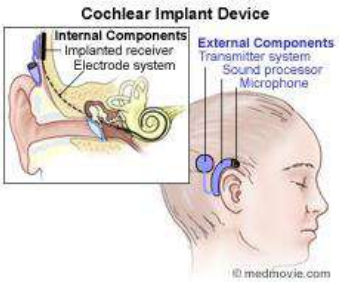
- Highly heterogenous
- More than
  - 400 genes contribute to hearing loss [mostly syndrome]
  - 100 genes associated with nonsyndromic hearing loss
  - 1000 mutation
  - 140 loci

Essential Question:

- If you were hard of hearing, would you want a cochlear implant? Why or why not?

Cochlear Implants

- How well can an implant recipient actually hear?



Device Type

Duration of device use	Hearing Aid	Cochlear Implant
0 to 1 year	Every 3 months	Every 2-3 months
1 to 2 years	Every 3 months	Every 6 months
2 to 3 years	Every 3 months	Every 6 months
3 to 5 years	Every 6 months	Every 12 months
> 5 years	Every 12 months	Every 12 months

Gene is inherited from a parent

- 400 kinds have been identified!
- Syndromic or non-syndromic

Examples:

- Usher's Syndrome
- Connexin Cx26/Cx30
- Usher syndrome
- Mitochondria genes

Syndromic hearing loss

- Hearing loss is associated with other clinical features
- Autosomal dominant
  Wardenburg syndrome
- Autosomal recessive
  Pendred syndrome
  Ushers syndrome
- X- linked
  Alport syndrome

Mitochondrial mutations

- Mitochondria organelle responsible for energy production
- Mitochondria have there own DNA
- Egg cells pass on the mitochondria ; sperm cell do not

Louisiana Acadians

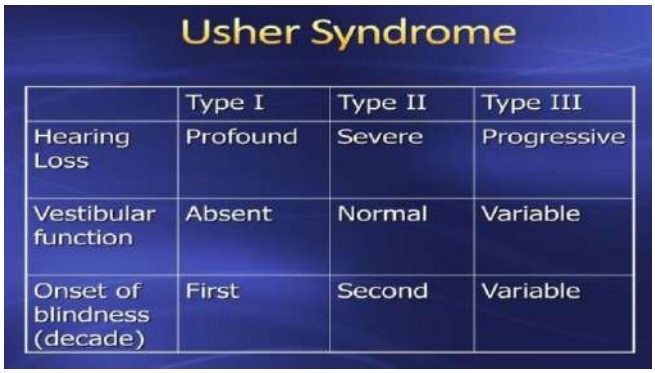
- French descendants of Canadian nova scotia Acadians eho migrated to louisisana in the 1700
- Reside in the southern part of Louisiana

Louisiana Acadians and genetic disorder

- Founder population : a population that is founded by a small number of member from a larger population
- Geographically and culturally isolated population are at a higher risk of genetic disorder when compared to the general population
- Autosomal recessive disorder are amplified in such population
- Examples of genetic disorder in this population
- Ushers syndrome [combined deaf/blindness]
- Non syndromic deafness

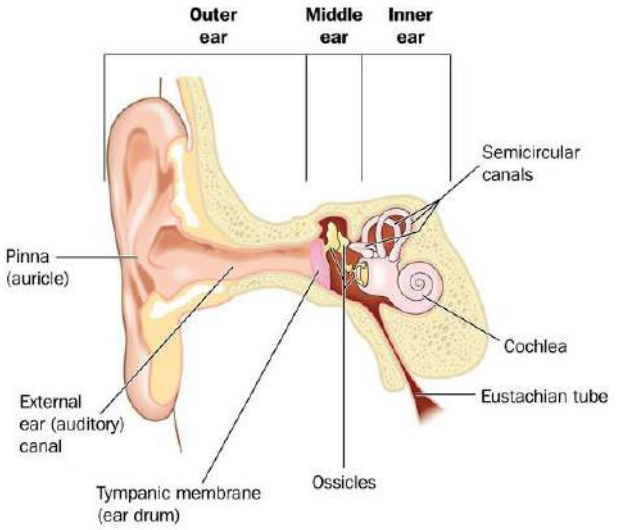
Ushers syndrome

- Congenital deafness with progressive blindness
- Accounts for about half of all concurrent deafblindness cases in adults
- Rare , but is estimated to be 6 timews more common in lousiana Acadian population
- Incidence : 3 to 6 in 100000
- Increased incidence in acadiana population in lousiana and Ashkenazi jewish
- Type 1 c is most variant in lousiana acadiana population
- Physical feature
- Sensory neural hearing loss , often profound
- Progressive vision loss
- Possible balance problem
- Autosomal recessive inheritance



Usher's Syndrome

1. It is characterized by congenital severe to profound hearing loss at birth, vestibular and impaired activity development at very young age, and progressive retinal dysfunction pathological changes with vision deterioration from loss of and central peripheral vision-visual field sensitivity at a young age to complete blindness in early adulthood
2. Residual low frequency hearing in this type of Usher syndrome is usually in the range of 90100 dB HL, unable to benefit from hearing aids and requiring cochlear implant.
3. Age is probably the most critical prognostic indicator in cochlear implant for Usher syndrome. Usher syndrome can cause dysfunction of both auditory and visual organs, and while sign language communication is possible at early ages, it eventually becomes impossible after loss of vision and the patient has to rely on verbal communication. Cochlear implant is therefore especially important as a way to acquire hearing and speech functions in these patients.
4. word test scores showed the greatest increase in children <3 years of age when receiving cochlear implant than in those receiving implant at an age older than 6 years, indicating that early intervention before loss of vision is crucial to development of effective hearing and speech capabilities



Waardenbury syndrome (WS)

I. North Carolina at Chapel Hill, five of the seven patients who had received cochlear implant showed 100% closed set word recognition score and greater than 50% open set word recognition scores soon after implantation.

II. Patients have shown above average results in post-implant closed and open set word tests. Reports from overseas have stated that WS patients enjoy better cochlear implant outcomes than those with with inner ear malformation or non-syndromic deafness "normal" cochlea.

Connexin 26 [GJB2]

- connexin 26 is responsible for about 40% of all autosomal recessive nonsyndromic hearing loss cases.
- Onset is usually prelingual
- Degree varies from mild to profound.
- Can vary within same family
- High frequency may be more severely affected
- >200 different mutations have been identified.
- 35deiGmutation accounts for ~70% of cases
- Mutation disrupts potassium flow in the cochlea.
- Statistical analysis suggests that the length of implanted electrodes may be a better indicator of cochlear implant outcomes than hereditary factors.
- Cochlear implant outcomes in four Japanese children with homogenous Cx26 233delC mutation and profound hearing loss, and reported that speech understanding in these children were better than in deafness patients without Cx26 mutation.

Pendered syndrome

- Incidence : 1 in 13000
- Physical feature
- sensorineural hearing loss
- thyroid goiter
- enlarged vestibular aqueduct
- mondini defect in 50% of patients
- may have balance problems
- autosomal recessive inheritance

PDS (SLC26A4) gene-related deafness

1. PDS gene was also responsible for large syndrome (LVAS). There vestibular aqueductare about 140 types of PDS mutations discovered among patients with PDS.
2. circulation, and subsequently enlarged vestibular aqueduct and increased Inner ear fluidendolymphatic pressure, which can cause hair cells damage and hearing loss.
3. PDS mutations and severe or profound hearing loss, is an effective cochlear implant treatment to improve hearing. Research, however, shows that postoperative in these children are not
4. hearing thresholds significantly different from those in patients with normal inner ear anatomy (El-Amraoui and Petit, 2005).

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Counselling in Cochlear Implant

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ABSTRACT

Cochlear implant is an electronic device which helps to provide sense of sounds to a person who is profoundly deaf. Prior the implant and after the implant, audiologist needs to counsel the parents or care givers regarding the CI. Psychologist also plays an important role in counselling of CI.

Cochlear Implant

A cochlear implant is a small, complex electronic device that can help to provide a sense of sound to a person who is profoundly deaf or severely hard-of-hearing. The implant consists of an external portion that sits behind the ear and a second portion that is surgically placed under the skin.

Counselling

Counseling is an ongoing part of the pre and postoperative evaluation process.

Pre counseling

The practitioner carefully counsels the parents/care givers on expectations for device use and establishment and development of listening and spoken language skills and pre pares the child for the world of sound

Tips for counseling parents of children with hearing loss:

- Parents need time to mourn their child's hearing loss before they can begin to make good decisions about pursuing a cochlear implant.
- Parental decisions need to be supported by the audiologista persuasion model of counseling is a poor one.
- A parental support group may be the best resource to help parents reach an informed decision.
- Careful listening and reflective responses used in conjunction with information presented sensitively are the best counseling tools.
- Support will be needed for the child and the school system in order for there to be a successful outcome in using the implant.

Post counseling

The practitioner carefully counsel the family about the function of cochlear implants and what they can do is just as important as focusing on what implants cannot do

For example -

1. Get clearance from ENT surgeon before device switch on.
2. Get regular listening training
3. Get cochlear implant mapping done regularly

For realistic expectations audiologist need to counsel parents of children with additional disabilities like children with Mondini dysplasia. Psychological aspects in counseling of CI- Prior to implantation it is necessary that a psychologist makes an accurate assessment in order to able to intervene in situations where there is parental stress and help them cope by implementing a copying paradigm. During the assessment an important aspect for the psychologist is evaluating the motivation towards the rehabilitative program and the strong interaction between the parents and the child. During the post implant period improvement of parental behavior as well as the development of the child in the domains of shared attention, problem solving, symbolic play and social functioning.

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Phonetic Acquisition in Children with Cochlear Implant

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Abstract

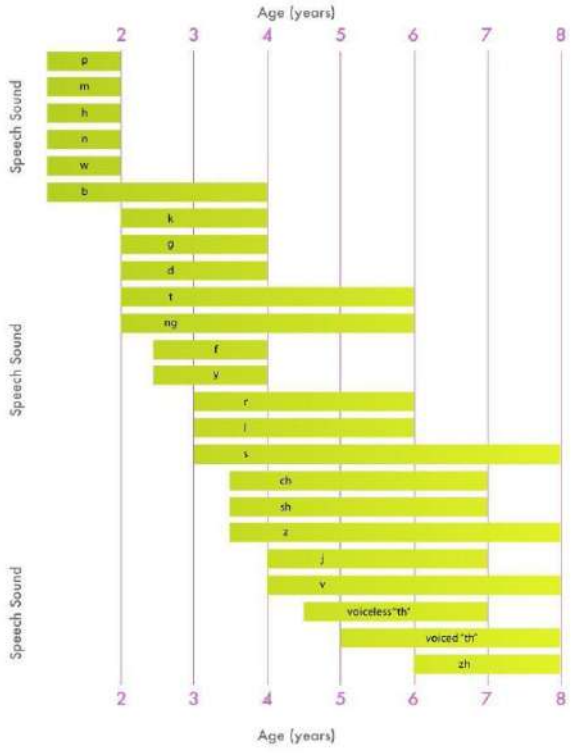
Phonemic acquisition refers to speech sound production, which is determined by articulatory and motor skill. Cochlear Implants (CIs) have been approved for use in children over 2 years of age since 1989 and in children as young as 12 months since 2000 (National Institute of Health and Human Services, 2010). Early implantation has been strongly advocated and repeatedly shown to be beneficial since then as a means to encourage timely and accurate development of speech (ShuChen, Spencer, & Tomblin, 2004; Tomblin, Barker, Spencer, Xuyang, & Bruce, 2005; TyeMurray, Spencer, & Woodworth, 1995). However, even when implanted relatively early, children with CI still have lost the early hearing experiences available to all children with normal hearing (NH), which may significantly impact their speech development. For example, Stoel Gammon and Otomo (1986) reported that although NH infants and infants with hearing loss both began babbling at the same age, their speech development did not follow the same trajectory.

Pattern of speech phonetic acquisition in children with CI's

Once implanted, children with hearing loss have been shown to resume a normal, or near normal developmental rate and sequence of speech sound acquisition (Spencer and Guo, 2013). In fact, several researchers have demonstrated that no significant differences exist between the speech production abilities of children with CIs and typically developing children when device experience, as opposed to chronological age. (Flipsen, 2011; Spencer & Guo, 2013). Because the children with CIs are able to acquire language in 12 months that children with NH developed over 2 years, this finding strongly suggests that children with CIs are able to ―catch up‖ much more quickly than NH children with similar language experience. Nevertheless, differences in the order and rate of consonant acquisition between CI and NH children have been reported.

Phonemic inventory and rate of acquisition in children with CI's

Several authors have attempted to measure consonant inventory size in children with CIs at different stages of development. A phoneme is considered acquired by a child if at least 50% of the attempts are produced correctly in intelligible words. After four years of robust hearing experience, the children with CIs only mastered 13 of 24 phonemes. Glides and nasals are acquired earliest. Fricatives and affricates are acquired last. Additionally, the more "visible" bilabial and labio-dental sounds are acquired earlier than other consonants. These findings are generally consistent with the order of acquisition for typically developing children. The rate however, is slower since typically developing children had acquired 22 of 24 consonants at four years of age. Phonemic acquisition of Children with C and normal hearing developing children are typically same, just at a slower pace.



Atypical emergence of selected phonemes

Sometimes, rather than following a strictly developmental sequence, the speech of children with CIs has been shown to deviate in several important ways. For example, several typically later-developing phonemes are found to emerge

earlier. These included /r/ and /t/, which typically develops early in NH children, are repeatedly found to be delayed in children with CIs (Blamey, et al., 2001; Chin, 2003; Ertmer et al., 2012; Spencer & Guo., 2013). According to the Iowa-Nebraska norms (Smit et al., 1990), 87% of typically developing children produce /t/ (or a phonetically appropriate allophone) at 36 months. However, in children with CIs, the acquisition of /t/ was noted 4 to 6+ years post implantation.

This low level of accuracy could not be related to place of articulation since production of both /d/ and /n/ had very high accuracy rates (each above 80%) in the initial position of words. So, the difficulties with /t/ production are not easily explained.

CONCLUSION:

The development of phonemes speech sound show many similar tendencies. vowels are mastered by the age of three years ,most consonants by the age of four and most consonant clusters between 5 and 6-8 years of age .many investigation of speech development in children with CI'S have shown initial accelerated growth ,followed by a plateau where consonant order of acquisition generally mirrors that of normal hearing , but is slower (Blamey et.al , 2001 ; serry and blamey , 1999) .A notable exception to this pattern,/t/,has been shown to be acquired later than normal in several investigations (Blamey et.al 2001 ;Chin , 2003 ;Ertmer et.al 2012).This is achieved by examination of listener ratings of CI and NH production.

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Pragmatic in Cochlear Implant

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ABSTRACT:
Pragmatic language refers to the social language skills that we use in our daily interactions with others. This includes what we say, our non-verbal communication (eye contact, facial expressions, body language etc.) and how appropriate our interactions are in a given situation. Many children will have difficulty with some components of pragmatic language. Children with cochlear implant may have particular difficulty with many of these skills due to their deficits with social interactions. Children with difficulties in this area often misinterpret other people communicative intent and therefore will have difficulty responding appropriately either verbally or non-verbally.

Pragmatic

Pragmatic language ability refers to the ability to use language in a social context. It has been shown to be related to core language ability, including language comprehension and vocabulary skills, and also to cognitive skills (Matthews et al. 2018) for example: inhibition, shifting, working memory and reasoning ability. (Turkstra et al. 1996).

- Pragmatic language skills, including conversational skills, support children's ability to establish and maintain acceptance into peer groups. (Schley & Snow, 1992)
- Pragmatics and conversational skills of children with cochlear implants have received limited empirical examination. (Lloyd et al., 2007).
- Analyses of pragmatics and conversations between adults and children with cochlear implants (CI) reveal that children:

1. May be less likely to understand when a conversational breakdown has occurred.
2. Are more likely to provide inadequate or unrelated information within a conversation.
3. Tend to produce more comments than questions.
4. Are more likely to initiate terms by behaviorally touching and may relate on simple responses.
5. Whereas these differences have been documented in adults to child to conversations, much less is known about the conversational skills of children with CI in peer-to-peer interactions.

Pragmatic Language Skills in Children with Cochlear Implant

Pragmatic language skill is an umbrella term for a number of complex verbal and non-verbal skills needed for real-life conversations. These skills range from responding to utterances in an appropriate way, maintaining the topic of the conversation, initiating new and relevant topic, to not inappropriately interrupt the other speaker, turn-taking, the ability to ask for classification and adapting the language to the needs of the conversational partner.

Children with CI have been found to perform more poorly on a number of pragmatic language abilities. Jeanes (2000) analyzed referential communication between children and found that profoundly deaf high school students using oral communication use requests for clarification more often than their hearing peers. However, in comparison to the hearing groups, the requests were more often nonspecific, which led Jeanes (2000) to suggest that the communicative competence of the deaf and hard of hearing children is not as mature. Ibertsson et al (2009) as well-found, teenagers with CI to use more requests for clarification when communicating with the well-known peer without a hearing loss. However, in contrast to Jeanes (2000) in the study by Ibertsson et al. The teenagers with CI mostly use specific requests for clarifications. The pragmatic language skills of children with CI at age 9-12 are good enough to ensure a fluent conversation, but that they tend to control the conversation more than children without hearing loss. Children with CI try to control the conversation more in order to prevent conversation break down. Children with CI and children with hearing aids showed problems in the area of turn taking, the ability to have a conversation with smooth interchanges between the conversational partners. This was especially the case for contingency, a skill which none of the children with CI or HA used appropriately, and response and adjacency (no pause between the utterance of the conversational partner and the child's utterance), two skills which were only used appropriately by two of the children with CI or HA. In order to capture how well children are doing in real-life, other studies have used questionnaires to measure pragmatic language skills in children with CI.

It has been suggested that pragmatic language ability is not only connected to other language skills but also to different cognitive abilities point out that it is hard to distinguish between pragmatic language ability and the ability to understand words and sentences. The authors add that some children still mainly show language problems in a social context and that it is therefore important to try to separate these skills. Children with CI have been found to perform more

poorly than children without HL on a number of executive function skills, like working memory, reasoning and cognitive flexibility. These abilities seem to be associated with pragmatic language ability in normally developing children. A delay in these cognitive functions might therefore lead to a delay in pragmatic language skills.

Assessment of Pragmatic Skills:

For the assessment pragmatic skills, pragmatic behaviors are assessed with some sample activities.

PRAGMATIC BEHAVIOR	SAMPLE ACTIVITIES
1. Respond to greetings	Observe the client's response when you say, hi! How are you? Put your hand out to shake hands.
2. Make requests	Ask child to draw a circle but don't immediately provide a pencil. Ask "what would you say to your mom if you were in the grocery store and wanted a candy bar?"
3. Describe events	Ask the child what he or she did this morning. Ask the child to tell you about a holiday or special occasion.
4. Define words	Ask the child to define words such as: scissors, kitchen, and computer.
5. Make eye contact	Consider whether the child has maintained normal eye contact during the other parts of this assessment. Ask the child to tell you his/her address or phone number.
6. Attend to tasks	Consider how the child has attended to this assessment. Ask the child to describe a picture you provide.
7. Understand object functions	Ask the child to show you to use scissors. Ask what a ruler is used for.
8. Sequence actions	Ask the child to describe the steps involved in making the bed, buying groceries, or writing a letter.

CONCLUSION:

The results of the current studies suggest that many children with CI show pragmatic language ability comparable to their hearing peers and in accordance to their age-norm. The quality and quantity of face to face interactions influence both theory of mind and pragmatic language ability. The children with better developed semantic network are able to use language in a more flexible way.

To be able to develop interventions for children with CI showing problems in the pragmatic language domain it is important to get more insight into the connection between conversation, verbal fluency, and pragmatic language ability.

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Speech Intelligibility in Hearing Impaired

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ABSTRACT:
Verbal expression of our thoughts, ideas, emotions, and feelings is called speech. During this process our four systems respiration, phonation, resonance and articulation work together. Dysfunction to any of these system results in poor fluency or unintelligibility of speech, thus speech intelligibility is precise perception of normal listener to understand spoken word or phrase. Hearing impairment affects the normal development of speech due to limited or lack of auditory feedback. In general, it has been found that as hearing level increases, speech intelligibility decreases (Smith 1975).

Speech Intelligibility:
Speech intelligibility is that aspect of speech language output that allows the listener to understand what the speaker is saying (Nicolosi, Harryman & kresheck 1996). Intelligibility of speech refers to the accuracy with which a normal listener can understand spoken words, phrases, and sentences. Typically developing children usually acquire this skill effortlessly, with 97% of children producing intelligible speech by 4years of age.

Factors Affecting Speech Intelligibility:
Speech intelligibility is influenced by the competence of the talker and the nature of the spoken material (isolated words or connected speech). Ability with hearing loss to extract speech information from an audible signal decreased with increasing in hearing loss. This hearing loss desensitization was significantly related to hearing thresholds, sharpness of psychophysical tuning curves, and presence of dead regions, age, and cognitive ability.

Speech intelligibility is depending on different degrees of hearing loss, articulation of talker, phonetic construction, word familiarity and word environment. Speech intelligibility is influenced by the environment or limitations on the communication channel.

Intelligibility in Hearing Impaired:
Hearing impairment effects the normal development of speech due to limited or lack of auditory feedback. It diminishes the ability to hear faint sounds and often complain difficulty in understanding speech in noise. Speech intelligibility depends upon listening skills deaf children. Prelingually deaf or severe to profound children shows "6" intelligibility (never understand the child's speech). The speech of the children with moderate to severe hearing losses (i.e., Hard of hearing children) has been found to be more intelligible than the speech of children with profound losses. The systematic relationship between degree of hearing loss and intelligibility breaks down, however, once the hearing loss reaches 85 dB HL (Smith, 1975; Monsen, 1978).

DEGREE OF LOSS	EFFECTS
Mild hearing loss (15-30dBHL)	Miss voiceless consonants and some misarticulation
Moderate hearing loss (30-50 dB HL)	Missing almost all speech sound at conversation level and misarticulation is seen as omitted and distorted sounds
Severe hearing loss (50-70 dB HL)	Speech not develop spontaneously, exhibit severe speech problems
Profound hearing loss (> 70 dB HL)	Severe speech problems, voice pitch is often very high, absence of prosody makes their speech monotonus

A 6-point speech intelligibility rating scale, which is used for rating the speech production abilities

INTELLIGIBILTY RATING SCALE

Description of Speech Sample	Point Scale
Normal	0
Can understand without difficulty however feel speech is not normal	1
Can understand with little effort occasionally need to ask for repetition	2
Can understand with concentration and effort especially be sympathetic listener	3
Can understand with difficulty and concentration by family, but not others	4
Can understand with effort if content is known	5
Cannot understand at all even when content is known	6

Speech Intelligibility of Children with Cochlear Implant:
Hearing aids and cochlear implantation are devices which

make speech audible at a comfortable level and provide as many acoustic cues as possible without over-amplifying any sounds, especially loud sound. The subjects with early onset of deafness who received their single or multichannel cochlear implant before age 10 demonstrated the highest speech intelligibility whereas who did not receive their device until after age 10 had the poorest speech intelligibility. After cochlear implantation, the difference between the speech intelligibility ratings increased significantly each year.

Conclusion:

Speech intelligibility is depends on the type and degree of hearing loss if degree of hearing loss increases than speech intelligibility decreases. The speech intelligibility improves regularly the five first year post implantation so five first year is very important for cochlear implantation. Rehabilitation in initial years is important for normal language development.

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Speech Development in Prelingually Deaf Children with Cochlear Implants

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Abstract : Since the early 1980s, cochlear implantation has been an approved method for treating profound bilateral sensorineural hearing loss in children. It is widely believed that the use of this device would significantly benefit young deaf children's development of speech and ability to participate in auraloral communication. However, whereas significant improvement in speech reception and perception skills following implantation has been widely documented, cochlear prostheses as speech production aids have been studied less extensively. The main objective of this article is to review the work conducted on speech produced by prelingually deaf children following cochlear implantation. Cochlear implants and their functioning are described, as are the cognitive, social and clinical factors known to play a role in successful implantation of children. It is concluded that cochlear implantation may speed up speech production to near normal rates, but initial delays are not totally reversible. In addition, the variability in all performance measures is high, and the reasons for good and poor outcomes are only partly understood.

Cochlear Implantation for Adults with Prelingual Deafness:

Deafness in Adults: Age of Onset Matters

Adult CI candidates who once had normal hearing and experienced hearing loss later, or had some degree of hearing loss in childhood that worsened over time, typically have spoken language skills including intelligible speech. In contrast, adults with congenital deafness (present at birth) who never derived significant speech perception benefit from conventional hearing aids, generally have less well developed spoken language skills. If they did not use amplification consistently, there is an even greater chance that their use of spoken language is more limited. Despite the fact the individuals in the described categories may have similar audiograms indicating bilateral profound hearing loss, their spoken language skills may differ significantly. Further, expected outcomes with a cochlear implant are also quite different.

Congenitally Deaf Adults:

The speech intelligibility of congenitally deaf adults may be poor. Spoken language may be hampered in other ways and listening ability may be quite limited. These CI candidates likely are unable to detect all speech sounds and many environmental sounds are not detectible. Many such individuals do not demonstrate spontaneous listening behaviors and will require speech reading and/or sign language, even in quiet. Repetition and a slower speaking rate may also be needed.

CI outcomes for this adult population:

It can be generalized that congenitally deaf adults will continue to need speech reading and/or sign language following cochlear implantation. Nonetheless, we cannot predict with certainty that they would not benefit from the auditory information they would derive from a cochlear implant. Some individuals with this hearing profile may even gain some open set listening with a CI.

Although cochlear implantation has advanced dramatically, device outcomes are impacted by many factors including patient characteristics. In assessing candidacy, it is important to consider:

- What are your expectations? Can a CI help you to fulfill some or most of these expectations?
- Will you undergo rehabilitation to help you realize potential benefits?

With regard to rehabilitation, it is important to both follow through and find a means to customize a program to meet the person's specific needs both subjective and objective outcomes. Assessment of outcomes should include a range of possible benefits including access to speech, one's own spoken language, environmental sounds and music. Changes in life circumstances may also affect communication needs. Such changes may include, for example, living with parents versus living independently; mainstream educational settings as opposed to supportive settings; moving into a workplace that does not fully accommodate hearing loss; or expanded social interactions with a greater range of people.

A broader appreciation of possible benefits allows one to assess CI outcomes more accurately, particularly for this group of adults. Therefore, a consideration of CI candidacy should be undertaken without preconceived notions regarding potential benefits of the intervention on someone's quality of life.

Our ability to understand this complexity is key to defining needs, goals and rehabilitation strategies which may augment the opportunity for a prelingually deaf adult to realize the full benefit of a cochlear implant over time.

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Incidence & Prevalence: Early Detection & Intervention

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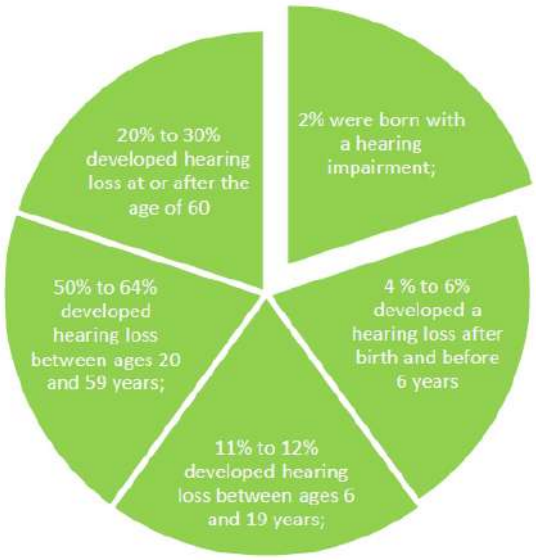
Although the profession of Audiology was formed under the aegis of the military, its growth was rapid within the civilian sector because of the general prevalence of hearing loss and its devastating impact was more…

- Hearing impairment is the most frequent sensory deficit in human populations, affecting more than 250 million people in the world.
- Consequences of hearing impairment include inability to interpret speech sounds, often producing a reduced ability to communicate, delay in language acquisition, economic and educational disadvantage, social isolation and stigmatization.
- It may be worsened by some medical conditions such as hypothyroidism, diabetes, and possibly hyperlipidemia, among others.
- The reported prevalence of Hearing Loss varies somewhat depending on the method of estimation like the criteria used to define hearing loss, and the age of population sampled.
- As per updated report of WHO in 2013, prevalence of hearing loss increases as per age with maximum incidence above age of 65 years.
- National survey results show that in the population of those with hearing impairment data from the National Health Interview Survey, 2007, retrieved from the National Institute on Deafness and Other Communication Disorders [NIDCD], 2010).



- Statistics in India suggests that one in twelve persons have hearing loss (Project Deaf India, 2013).
- As per 2011 census, 19% of the disabled population suffers from significant hearing Loss.
- According to WHO (2018) data, the prevalence of hearing impairment (HI) in India is around 6.3% (63 million people suffering from significant auditory loss).
- Report from Shield (2006) states that 1 in 7 people in UK or around 9 million people are suffering from hearing impairment.
- By 2015 , it was 13 million people are suffering from hearing impairment (above 65 years

Findings from the National Health and Nutrition Examination Survey indicated

- 14.9% of children between 6 and 19 years of age had a hearing loss of at least 16 dB in either low or high frequencies; the majority of these losses were classified as slight (16-25 dB; Niskar et al., 1998).
- Hearing loss of at least 25 dB at the speech frequencies has been reported in 29% of adults 50-59 years old, in 49% of adults 60-69 years old, and in 63.1% of adults ages 70+ (Agrawal, Platz, & Niparko, 2008; Lin, Thorpe, Gordon-Salant, & Ferrucci, 2011).
- More than 50% of prelingual deafness is genetic. Of the genetic hearing losses, most (70%) are nonsyndromic and, of these, 75%-85% of cases are autosomal recessive (Smith, Shearer, Hildebrand, & Van Camp, 2014).
- The most common cause of intermittent, mild-to-moderate acquired hearing loss in infants and young children is conductive hearing loss associated with otitis media.
- Noise-induced hearing loss is an increasing concern for children and adolescents. Niskar et al. (2001) estimated that 12.5% of U.S. children (ages 6-19) have evidence of noise-induced hearing threshold change.
- In adults, noise and aging are the primary causes of hearing loss.
- In the North American World Health Organization (WHO) subregion, 9% of all adult-onset hearing loss is likely attributable to occupational noise.
- females (1%-9%;
- Males between the ages of 45 and 79 (2%-14%)
- A higher percentage (20%) is attributable to occupational noise for adult males with hearing loss between the ages of 15 and 44

Early Hearing Detection and intervention (EHDI)

- Early Hearing Detection and Intervention (EHDI) refers to the practice of screening every new-born for hearing loss prior to hospital discharge. Infants not passing the screening receive diagnostic evaluation before three months of age and, when necessary, are enrolled in early intervention programs by six months of age.
- Infant hearing screening is emerging rapidly as a silent global revolution for the early detection of children with congenital or early onset hearing loss to ensure timely enrolment in family-oriented intervention programs for the development of speech and language.
- By 2005, Every State had implemented a new Born Hearing Screening Program, 95% of Newborn infants in the United States are screened for Hearing Loss prior to Hospital Discharge.
- In 1993, only 11 Hospital were screening more than 90% of their newborn.
- During This Same time period, It became Clear That Screening is only the first Step in a ―Process‖ necessary to identify infants and Young Children with Hearing Loss.
- The Next step is to Provide these Children and Their Families with timely access to diagnostic follow up and ,when necessary, referral to appropriate, Culturally sensitive ,and family centered intervention services.
- Experience has shown that, in order to successfully identify and serve infants and young children with hearing loss and helps their families, professionals must go beyond Screening.
- To be Successful, All elements of follow up need to be included to meet and serve the child's and family's complex needs.

Early Intervention

- Hearing impacts speech, language, learning, and social skills. Getting help early is important. Learn more about the hearing loss and your child's development.

EI services include

- The family and will help your child with his speech and language skills
- Help you understand your child's hearing loss and listening needs
- Support you so you feel that you can help your child
- Keep track of your child's progress.

School Services

- Your child gets services in school under IDEA.
- The Rehabilitation Act is another law that may help your child.
- The Individuals with Disabilities Education Act, or IDEA, protects children with disabilities.
- IDEA makes sure that children receive the services they need for free. The law covers children from birth through age 21.
- The early intervention, or EI, program is for birth to age 3. The school age program is for ages 3 to 21.
- These laws say that the school must give your child the hearing services if they needs.
- The school must have hearing assistive technology, or HATS, if your child needs it.
- Devices that let your child hear in the classroom will help them to listen and learn.
- Schools must also make sure that teachers and others know how to work with your child.
- They need to know about his hearing loss and how to manage his hearing aids. They also need to know how to use HATS.

Realistic Expectations & Measurement in Hearing Aid & CI Recipients

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Measurement in Hearing Aids & CI Recipients

- CI process starts a new phase in which complicated emotions such as anxiety, hope and excitement that are experienced by the parents are described following the diagnosis
- One of the common study findings indicates that when the parents are given the appropriate information about the process involved in every phase, they can meet the requirements of the process more easily.
- Proper information on the process is extremely crucial because it guides the parents and makes them ready for the experiences in the forthcoming process
- These challenges may include; overlapping of the decision making and candidate evaluation phases, referral of the parents via specialist opinions during the decision-making phase, different opinions of the specialists in referral procedures, the presence of open ended criteria, complications that may develop during surgery.
- Other challenges include; programming problems of the device, obligatory attendance to the auditory-verbal education by the parents, the presence of different approaches in auditory-verbal education, possible technical problems of the device.
- The financial burden of the device due to lack of inadequate allocation of resources by the government can also affect the different phases of the CI process. Despite all these challenges, the parents seem to prefer surgery to provide a good future for their child.
- The concept "expectation" evaluates the hope and thoughts of the parents concerning how CI application will contribute to the development and future life of their child
- To help the parents determine their realistic expectations by effectively informing and offering consultation to them
- When proper guidance is not provided by the specialists, realistic expectations are not formed thus leading the parents to experience a great disappointment

Plan a Counselling Session

To provide

- Sufficient professional information prior to cochlear implantation surgery
- Sufficient professional information about its effect on child's hearing loss prior to cochlear implantation surgery
- Sufficient professional information about effect of hearing loss on child's speech and language development prior to cochlear implantation surgery
- Sufficient professional information about effect of hearing loss on child's general development and development of his/her skills (social, academic, psychological etc.) prior to cochlear implantation surgery
- Sufficient professional information about hearing technologies (hearing aid, cochlear implantation FM systems etc.)
- Recommend a certain period of time for use of the hearing aid prior to cochlear implantation surgery
- Recommend hearing-speech-language therapy prior to cochlear implantation surgery
- sufficient professional technical (parts of the device, how it works, signal it irradiates etc.) about the surgery prior to cochlear implantation surgery
- Sufficient professional information about effectiveness of cochlear implantation (development of hearing, receptive and expressive language development, speech comprehensibility etc.) prior to the surgery
- sufficient professional information about efficiency of cochlear implantation (hearing in a noisy environment, localization of sound etc.) prior to the surgery
- Sufficient professional information about price of the cochlear implantation device prior to the surgery
- Any payment for cochlear implantation surgery
- Payment to make for cochlear implantation surgery had let you have financial difficulties
- satisfied with the informing about cochlear implantation recommended prior to the surgery
- Need more information about preoperative procedures (e.g. Ease of the surgery, side effects of the surgery, duration of surgery etc.) prior to cochlear implantation
- Child communicate via lip-reading and sign language, as well as hearing
- Child communicate by using hearing together with lip-reading

- Child communicate by using only hearing
- Advancement after cochlear implantation application meet your expectations in your child
- Observed participation of your child to domestic events after cochlear implant surgery
- Institution/university in which your child underwent surgery meet your all needs concerning the use of implant to the extent you desired
- Trust the implant vendor for technical support about the implant
- Informed by the specialists about conduction of periodical audiological evaluation for your child during the duration of use of cochlear implant
- Sufficiently informed by the specialists about new advancements in cochlear implant system
- Child need his/her implant all the time
- Child's satisfaction level about cochlear implant
- Your satisfaction level about your child's cochlear implant?

Expected Benefits

- Self-confidenceSelf esteem
- Music
- Social
- Behavioral
- Contact

Exepected Skill type

- Hearing
- Language and Speech
- Reading and Writing
- Academic

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Rehabilitative Strategies for Hearing Impaired: Speech & Language Developmental Aspects

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Hearing Impairment

- Partial or total inability to hear
- Occurs due to damage to one or more parts of the ear
  - Conductive
  - Sensori-neural
  - Mixed
- Depends on onset of loss
  - Congenital
  - Acquired
- During the first 3 years of life, children experience their most intensive stage of speech and language development. If they are not exposed to language during this time because of hearing loss, they will likely experience difficulty in acquiring language and speech and later, delays in literacy skills.
- Hearing impairment child have a normal central auditory nervous system, the brain's capacity to process spoken language is assumed to be normal
- Thus the critical factor in the acquisition of oral language for child with hearing impairment is the amount of auditory sounds & experience

Normal speech & language development

DURATION	SPEECH & LANGUAGE
0-6 months	Cooing, smiling at people, babbling
7-12 months	Pointing, imitating sounds, first 'true' word
1-2 year	Uses new words, joins 2 words together, uses mostly nouns
2-3 year	2-3 word phrases, asks questions, sounds like /k/ /g/ /f/ /n/
3-4 year	Answers simple questions, uses longer sentences, uses pronouns
4-5 year	Tells short story, continues a conversation, uses adjectives, fluency improves
5-6 years	Uses complete sentences, multi syllabic words are used, complete 5-6 word sentences

- Children with an impairment of hearing will also have issues with
  - Communication
  - Speech and language
  - Social
  - Cognition
  - Intellectual
  - Emotion
  - Education

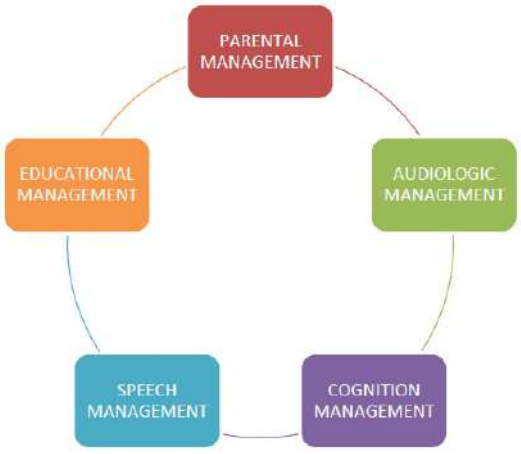
What is Aural Rehabilitation

- Aim: to restore or optimizing a patient's participation in activities that have been limited as a result of hearing loss
- Goals:
  - Alleviate the difficulties related to hearing loss
  - Minimize its consequences

Importance of Rehabilitation in young children

- Acquisition of language is linked to auditory sense
  - it is a time locked function related to early maturational periods
  - occur at the fastest rate between 0 to 3 years-known as critical period of development
  - Earlier and larger the auditory language stimulation-the better and efficient will be the language and speech skills

Effective Rehabilitation Management Model Should have



Auditory training (AT)

- Auditory training is a process designed to enhance the ability to interpret auditory experiences by maximally utilizing residual hearing.
- Auditory training involves a development and /or improvement in the ability to discriminate various properties of speech and non speech sounds (Goldstien 1939)
- Definition of auditory training is attributed to Carhart (1960), who considered the AT a process of teaching the child or adult with HI to take full advantage of available auditory cues.

When to start auditory training

- As soon as the child is fitted with a hearing aid

How to start auditory training?

- Should be exposed to sounds heard day-to-day life.
- Create awareness of those sounds
- Encouraged to listen & understand words/phrases or sentences
- This capacity is not same in all HI individuals.
- Also depends upon residual hearing, motivation etc.

Important pre-requisites to begin AT

i) Should be fitted with a suitable HA.
ii) Should be encouraged to cooperate in the program by suitable reinforcements.
iii) Selection of sound for training.
iv) The sound exposed often to be listed in hierarchy.
v) Materials for AT should be age appropriate.
vi) Plan the timing for training activities.
vii) Conditioning to respond to sounds.

Candidacy

1. Its most common use is with children with prelingual sensorineural hearing impairment, especially those with moderate to profound degrees of loss with congenital onset.
2. Another targeted population for AT in recent times has been cochlear implant recipients, both children and adults.
3. There is strong evidence that a structured program of listening training enhances the benefits derived from a cochlear implant.
4. Although extensive AT typically is not utilized with hard of hearing adults, certain factors, such as exceptionally poor speech perception and/or a severe to profound degree of loss.
5. Someone who has incurred hearing loss following trauma or use of ototoxic drugs may receive training to adjust to his/her radically altered listening state.
6. Speech through a listening device may sound different from how they remember it, & they must learn to interpret what they hear.

Goals of Auditory training

i) Better understanding of the spoken language of others
ii) More rapid development in the use of language
iii) Better speech clarity
iv) Higher academic achievement
v) Better social emotional adjustment through a link with the hearing world.

Success of auditory training involves factors such as:

1. Aspects related to the hearing loss and hearing aids.
2. Motivation
3. Intelligent cooperation with the clinician of those in close association with the Hearing Handicapped individual.
4. Cooperation between the teacher and the caregivers
5. Age of the client
6. Intelligence of the client
7. Practice materials employed by the clinician
8. Opportunity to have systemic practice and Use learned skills
9. Establishment of proper habits by the clients.
10. Ability of the client to understand the tasks (principles involved).
11. Appropriateness of Methods employed by the clinician.
12. Knowledge of progress

Methods of Auditory Training:

- Initially Auditory Training was categorized based on analytic, synthetic, or a combination of the two approaches. The more current approaches to auditory training vary considerably.
- According to Blamey and Alacantra (1994), it is possible to categorize them into one of four general categories, based on the fundamental strategy stressed in the therapy Analytic, Synthetic, Pragmatic, Eclectic

1. Analytic training : uses exercises with small segments of the speech signal such as phonemes or syllables and incorporate these separately into auditory training exercises.

- Ex: exercises that emphasize same-different discrimination of vowel or consonant phonemes in syllables (e.g., /bi-ba/) or words (e.g., /sIp-sIt/) or require the listener to identify a word within a closed-set response format (e.g., run-money-bat).
- Analytic training employs bottom-up tactics.

2. Synthetic training refers to training based on recognition of the overall meaning of discourse.

- Emphasizes a more global approach to speech perception, stressing the use of clues derived from the syntax and context of spoken message to derive understanding.
- It does not require awareness, identification or comprehension of every single small segment of the speech signal.
- Instead, it focuses on communication strategies and top-down processing.
- Training synthetically involves the use of meaningful stimuli (words, phrases, sentences).
- This might involve practicing sentence perception based on prior information about context (e.g., having

lunch, a classroom discussion on government) or having the clinician name a topic and present related words or phrases that the individual must repeat back.

3. **Pragmatic:** involves training the listener to control communication variables, such as

- the level of speech,
- the signal-to-noise ratio, and
- the context and complexity of the message.

4. **Eclectic** includes training that combines most or all of the strategies previously described.

- While the auditory training programs to be described all have analytic, synthetic, or pragmatic tendencies, most would best be described as eclectic, since more than one general strategy for the training of listening skills typically is used with a given child or adult.
- AT can be performed in either an individual or group format.
- A major limitation of group therapy is the lack of individualized attention to patients, many of whom present unique problems and a wide range of abilities.
- The advantages of individual AR include personal treatment plans along with training at an optimal pace for the patient.
- However, it can be expensive from both a time and cost perceptive.

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Three General Auditory Training Approaches:

I) Natural conversational approach	➢ The teacher eliminates visible cues and speaks to the child in as natural a way as possible, while considering the general situational context and ongoing classroom activity. ➢ The teacher adapts to the child's responses by presenting remedial auditory tasks in a systematic manner (modifies stimulus and/or response), derived from any cell in
II) Moderately structured approach	➢ The teacher applies a closed-set auditory identification task, but follows this approach activity with some basic speech development procedures and a related comprehension task. Thus, the method retains a degree of flexibility. ➢ The teacher selects the nature and content of words and sentences on the basis of recent class activities
III) Practice on specific tasks	➢ The teacher selects the set of acoustic speech stimuli and also the child's range of responses,prepares relevant materials, and plans the development of the task, all according to the child's specific needs for auditory practice.

Auditory Training Approaches:

i) Wedenbery's Approach (Wedenbery 1951)
ii) Verbotonal (Peter Guberina, 1952)
iii) Acupedic Approach
iv) Carhart's Approach 1960
v) Erber (1982)
vi) Developmental Approach To Successful Listening II (DASL-II)
vii) Ski-hi
viii) Traditional Approach (1966, 1976)
ix) Ling's Approach
x) Speech Tracking/ Continuous Discourse Tracking
xi) Topicon (Erber 1988)
xii) SPICE
xiii) Auditory Verbal Therapy

Carhartz Approach

One of the earliest approaches in listening training which gives systematic steps was given by Carhart in 1960.

- Includes both childhood and adulthood procedures.
- Carhart's AT program for prelingually impaired children was based on his belief that since listening skills are normally learned early in life, the child possessing a serious HL at birth or soon after will not move through the normal development stages important in acquiring these skills.
- Likewise, when a hearing loss occurs in later childhood or in adulthood, some of the person's auditory skills may become impaired even though they were intact prior to the onset of the hearing loss.

Childhood Procedures: Carhart outlined 4 major steps or objectives involved in AT for children with prelingual deafness. It has 4 stages.

a) Development of awareness of sound
   - The child has to recognize when a sound is present and attend to it.
   - The child should be surrounded with sounds that are related to daily activities and that are clearly audible.

b) Development of gross discrimination
   - Initially involves demonstrating with various noisemakers that sounds differ.
   - Training at this level involves discrimination of several parameters of sound, such as frequency, intensity (loud versus soft) durational (long versus low) properties of sound.

Adult Procedures:

- AT with adults focus on reeducating a skill diminished as a consequence of the hearing impairment.

- This approach establish ―an attitude of critical listening‖ which involves being attentive to the subtle differences among sounds and can involve analytic drill work on the perception of phonemes that are difficult for the adult with HI.
- Lists of matched syllable and words that contain the troublesome phonemes, such as she- fee, so tho, met- let, or mash-math, are read to the individual, who repeats them back.
- It also includes phrases & sentences.
- Speech reading combined with person's hearing was also encouraged during a portion of the AT sessions.
- Carhart advocated the AT sessions to be conducted in 3 commonly encountered situations:
  i) Relatively intense background noise
  ii) Presence of competing speech signal
  iii) Listening on the telephone

Acoupedic Approach (Pollack, 1970)

- Pollack believed-use of audition is hampered when attention is divided between two or more sensory inputs
- She proposed a unisensory approach towards education and rehabilitation of hearing impaired children
- Also known as acoupedic method and excludes all visual cues such as speech reading during early training

Cognitive Auditory Approach by Grammatico (1975)

- Similar to Pollack's
- Auditory training is not viewed as an activity to be set apart from other educational procedures
- Her approach stresses
  - Sound awareness
  - Discrimination
  - Localization
  - Imitation of intonational patterns
  - Memory

Traditional approach:

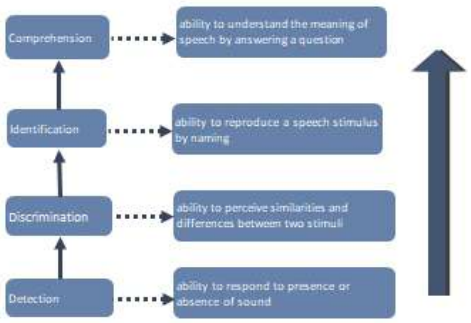
- Hirsh 66,Ling 76, have described 4 levels of audition that contribute to the perception of conversational speech, detection, discrimination, identification and comprehension.
- Detection: requires only the child should be able to distinguish b/w the presence and absence of sound
- Discrimination: involves differentiation of speech sounds.
- Identification: requires the child to recognize the speech signal and to be able to identify.
- Comprehension: involves understanding of the message on a cognitive and linguistic basis.

Auditory Verbal Therapy

- Lot of terminologies has been used to enable the individuals to use their auditory mechanism for communication.
- Commonly used are AT, listening training, and acoustic training & also auditory learning
- The first three are used interchangeably and the most commonly used term is auditory training.
- There are also other approaches that have been given specific terminologies such as auditory verbal therapy (AVT), auditory-oral method, and aural-oral method.
- Auditory learning: It is one in which activities for developing spoken language are related to the children real life experience and language stresses the comprehension of meaningful sounds which is considered to be highest level of auditory behavior (Erber 1982, Sanders 1982).
- Auditory-oral method: It's a method to teach language both receptive as well as expressive to children with HI. Some believe that along with the auditory cue speech reading can also be carried out.
- Aural-oral method: It is a method where the child develops/ taught language through the auditory mechanism and communicates through speech.

Principles of auditory-verbal practice:

1) To detect HI as early as possible through screening programs ideally in the newborn nursery and throughout childhood.
2) To pursue prompt and vigorous medical and audiologic management, including selection, modification and maintenance of appropriate HAs, a CI, or other sensory aids.
3) To guide, counsel and support parents and caregivers as the primary models for spoken language development and to help them understand the impact of deafness and impaired hearing on the entire family.
4) To help children integrate listening into their development of communication and social skills.
5) To support children's auditory-verbal development through one-to-one teaching.
6) To help children monitor their own voices & others in order to enhance the intelligibility of their spoken language.
7) To use developmental patterns of listening, language, speech and cognition to stimulate natural communication.
8) To continuously assess and evaluate children's development in the above areas and, through diagnostic intervention, modify the program when needed.
9) To provide support services to facilitate children's educational and social inclusion in regular education classes.



Hierarchy of Listening Skills

Universal Newborn Hearing Screening(UNHS)

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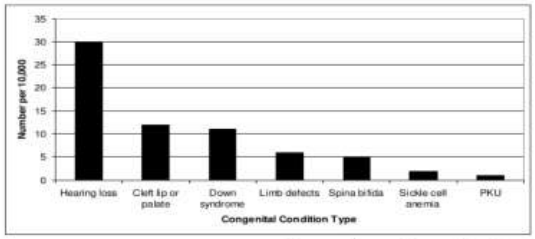
UNHS?

- Universal Newborn Hearing Screening(UNHS)
- Earlier "Newborn Hearing Screening(NHS)"
- Also known as "Early hearing detection & intervention (EHDI)"
- Its a approach that enables to identify congenital Hearing Loss.
- Use of an objective measurement of the auditory system to identify infants at risk for HL. (Allen and Farrell (1996). Adv Pediatrics 43: 231-270)

Incidence of HL

- Second most common disability.
- Substantially high incidence with congenital HL affecting 30 per 10,000 children. Wynbrandt,et al. (2009)
- 1 to 2 newborns per 1000 in the general population,
- 24% to 46% of newborns admitted to NICU. Berg, et al. (2005Al-kander, et al. (2007)

INCIDENCE OF CONGENITAL CONDITIONS (PER 10,000)



Source: http://www.infanthearing

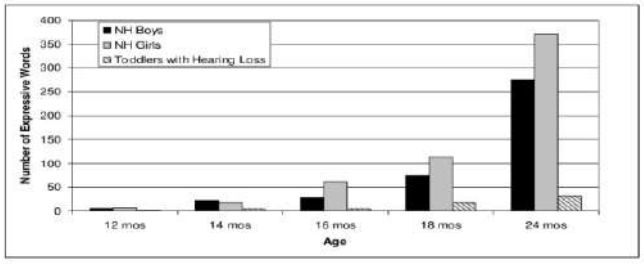
Need of UNHS

- Diagnosis is significantly delayed without screening.
- Symptoms & signs of HL are subtle in infants with HL.
- Significant expressive language deficit in children with HL.
- Average age at diagnosis is approximately 24 month (Duriex-Smith et al, 2008)
- Mild & moderate HL often undetected until school age. (Duriex-Smith et al, 2010)
- Functional outcomes of delayed diagnosis & intervention.
- Without early intervention à Irreversible deficits in communication, psychosocial skills cognition & literacy. Davis et al. (1986), Durieux-Smith (2000)
- Auditory deprivation in early infancy leads to structural & functional reorganization at a cortical level. Hardie et al. (1999), Sininger et al.(1999)
- Impact on socioeconomic & vocational status. Durieux-Smith et al. (2008)

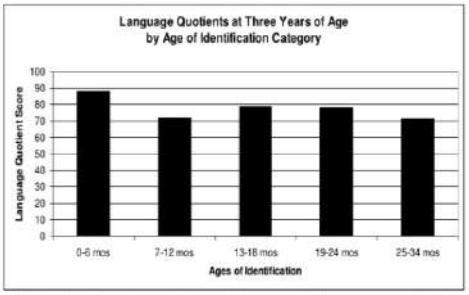
Functional outcomes of delayed diagnosis & intervention

- Reduced Expressive vocabularies.

VOCABULARY DEVELOPMENT IN INFANTS



EFFECTS OF AGE OF IDENTIFICATION ON LANGUAGE DEVELOPMENT



The participants' receptive and expressive language abilities were measured using the Minnesota Child Development Inventory.

Functional outcomes of delayed diagnosis & intervention.

AIM & Objective of UNHS

- Aim:
- Screening by one month of age
- Confirmation of the diagnosis by three months
- Intervention by six months

Objective:

- To identify children with all type & degree of HI (B/L & U/L)
- To lower the age at the time of diagnosis for early hearing amplification
- To maximize their linguistic competence & literacy development

When to screen ?

JCIH (2007) à "formula 1-3-6"

- Screened before 1-month of age.
- Confirm diagnosis of HL by 3 months & provide proper rehabilitation options (HA)
- Enroll the child for early speech and language intervention before 6 months of age

1. Family H/O/ Hereditary HL:

- Hereditary HL can be regarded as syndromic or nonsyndromic.
- CDHL/SNHL/Mixed HL/Dysfunction in Auditory Pathway.
- Approximately 80% of congenital HL is due to genetic causes. Shearer, et al. (2017)

2. Congenital / In utero Infection: TORCH

- Prevalence of childhood permanent congenital HL is 1.2 to 1.7 cases per 1000 live births.
- Mostly due to SNHL.(Korver, et al. (2010)

3. Craniofacial anomalies (CFA):

- Including those that involve the pinna, ear canal, ear tags, ear pits and temporal bone anomalies.
- Well reorganized association b/w CFA & HL.
- Type & Degree of HI varies with type of CFA involvement. (Hayes et al. (1994)

4. Low Birth weight.

Risk of HL

Low Birth Weight (LBW)	<2500
Very low birth weight(VLBW)	<1500
Extremely low birth weight	<1000

- Hyperbilirubinemia:
- VLBW & prematurity are often concomitant, & infants at greatest risk of SNHL.
- > 50% of children suffering from ANSD have a H/O hyperbilirubinemia and/or anoxia in the neonatal period. Rance, et al.(2005)
- Concentrations of bilirubin >14mg/dl represent a risk of HL. (De Vries, , et al. 1985,Martinis et al.2012)

6. Ototoxic medications:

- Aminoglycosides in multiple courses and/or in combination with loop diuretics.
- Gentamycin & tobramycinà most vestibulotoxic agents.
- Neomycin, kanamycin, & amikacinà toxic toward cochlea (Fausti et al.1999, Cristobal et al 2008).

7. Bacterial meningitis:

- 30% of bacterial meningitis cases result in some degree of HL.

8. Low Apgar Scores.

- Low Apgar scores 04 at 1 min or 06 at 5 min after birth have been used as indicators of birth asphyxia that has been associated with SNHL.

9. Mechanical ventilation & NICU lead to HL:

- Exposure to constant background noise generated by contemporary life-support equipment in the NICU can lead to HL.
- Average noise levels in neonatal units should be below 45 dB in infants' areas and that transient sounds should not exceed 65 dB. Cristobal, et al. (2008), Williams, et al.(2007)
- Prolonged (5 or more days) mechanical ventilation due to persistent pulmonary hypertension in a newborn has been associated with HL. Roberston, et al. (2009) , Hille et al Vos , et al. (2015) Richardson et al. (1997)

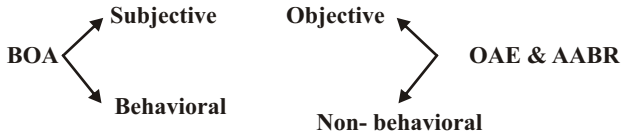
10 Syndromes associated with Congenital HL.

- Among genetic defects 30% causes are Considered as syndromic . Rehm, et al. (2005)

How to screen ?-Methods & Protocols

Universal Hearing Screening (UHS) : OAE & AABR

Community Hearing Screening (CHS) :BOA & OAE



Objective Tests: " Classified into 4 categories"

AABR only:

- Both neural & cochlear HL detected using one type of technology
- Used in NICU/in well-infant nursery

OAEs only:

- Use in NICU/in well-infant nursery
- Do not detect neural HL

OAE followed by AABR when the OAE is not passed:

- OAE screening is completed on both ears first.
- AABR is only done for those newborns that do not pass the OAE
- If U/L or B/L do not pass AABRà referred for outpatient diagnostic testing

Both AABR & OAE:

- Must pass both OAE & AABR screening.
- Who fails one or both screenings à referred for outpatient diagnostic testing.
- Most precise but expensive protocol

Counselling Parents in UNHS

Needs of parents/family during this process…

- What do we do next?
- When must we take action?
- Where do we get more information?
- How do we decide?
- Who will help us?
- Why do we need early intervention?

Benefit of UNHS

- Speech & Language Development:
  - Early identification of HL gives children the opportunity to develop significantly improved language skills compared with those children who are diagnosed later. (Yoshinaga-Itano (1999,2003,2004, & 2016), Pimperton et al. (2012)
  - Children identified with hearing deficit before 6 months of age may not have any speech & language delays and develop equally to their hearing Nikolopoulos (2015)
- Speech & Language Development.
  - Early intervention helps increase expressive vocabularies.

If remediated at birth.	300-700 words
If remediated at 6 months.	150-300 words
If remediated at 2 years.	0-50 words
3-year-old child with typical hearing	500-900 words

- **Reduction in average of Diagnosis:**
  - Prior to UNHS, average age of diagnosis of HI that compromised speech & language development was 26 months, with hearing aid fitting at 32 month .Yoshinaga-Itano (2003)
  - Prior to UNHS, severe HL was diagnosed on average at the age of 23 years & mild-to-moderate HL was often not identified until 4 years of age . Nikolopoulos (2015))
- **Cost benefit analysis :**
  - Early diagnosis saves the costs of intensive speech & language intervention and special education services. Thompson, et al. (2001), Akinpelu,et al. (2014) & Yoshinaga-Itano (2004)
  - Mean yearly societal cost in children with HI was 3 times higher than cost of normally hearing children at 79 y of age .Schroeder, et al. (2006)

Limitation in UNHS

- Need comprehensive & organized approach (screening, diagnosis, intervention & F/U).
- Less severe congenital HL (< 30/40 dB) not detected.
- Progressive/ late onset HI may not be detected.
- In two step screening, low risk infants with ANSD may not be detected by OAE test alone.
- Hearing (re)assessment is recommended for all children experiencing developmental or learning difficulties.
- Patel et al, Universal newborn hearing screening. Paediatr child Health 2011;16(5):301-305.

Govt. Programs

- National Programme for Prevention and Control of Deafness (NPPCD) - Government of India, in 2006
- Rashtriya Bal Swasthya Karyakram (RBSK). - Government of India, in 2013

Current Hearing aid Solutions

S M Tarique
MASLP
Audiologist & Speech Language Pathologist

Hearing aids

- Electronic device usually worn in or behind the ear of a hearing-impaired person for amplifying sound.

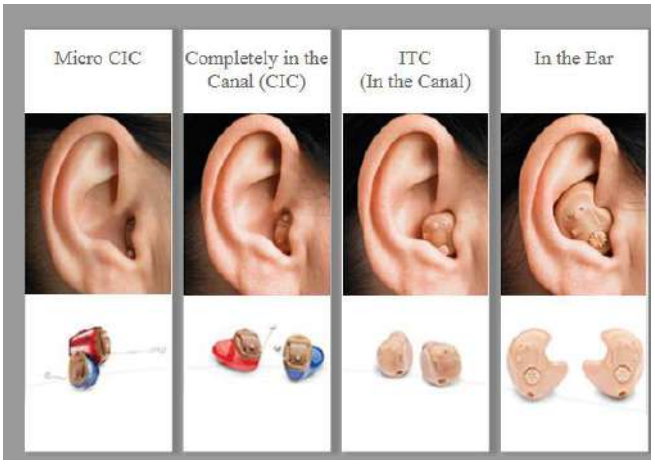
Components

- Microphone
- Amplifier
- Receiver (Speaker)
- Power supply (batteries)

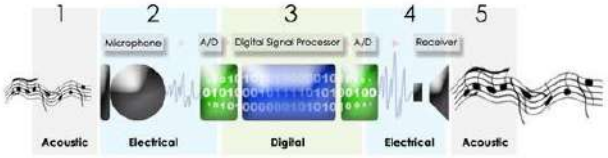
Types of Hearing Aid

Based on Size

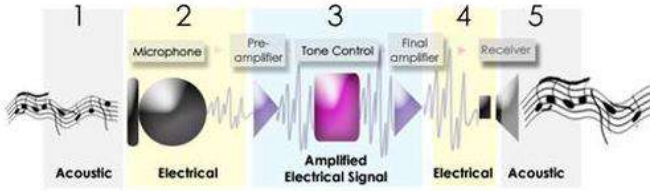
- Pocket Model/ Body Worn
- Behind The Ear- BTE
- Receiver In The Canal (RIC/RITE/RIE)
- In The Ear - ITE
- In The Canal - ITC
- Completely In The Canal - CIC
- Invisible In The Canal / Micro CIC - IIC

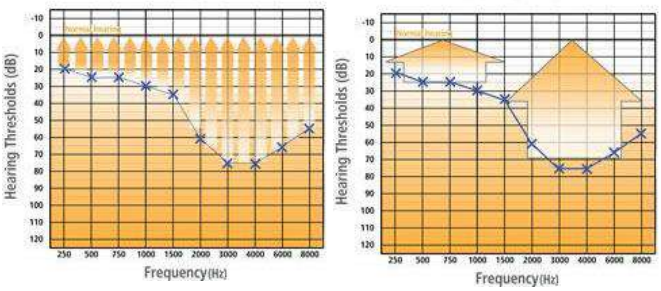


Working



Digital hearing aid





Batteries

Size	Color Code	Dimensions (WxH)	Typical Uses	Average Lifespan
675	Blue	11.6mm x 5.4mm	Power BTE hearing aids	9-20 days
13	Orange	7.9mm x 5.4mm	BTE hearing aids ITE hearing aids	6-14 days
312	Brown	7.9mm x 3.6mm	Mini BTE hearing aids RITE hearing aids ITC hearing aids	3-10 days
10	Yellow	5.8mm x 3.6mm	Mini RITE hearing aids CIC hearing aids	3-7 days

Technologies & features of hearing aids:

- Speech enhancement
- Noise Reduction
- Microphone Directionality

Automatic Analysis of Environment

- Sound Nav (Unitron)
- AutoSense (Phonak)
- Acoustical Environment (Signia)
- Surround Sound (GN Resound)

Audiometry using hearing aids

- In Situ Audiometry (Unitron)
- Sensogram (Widex)
- Audiogram Direct (Phonak)
- InSitu Gram

Frequency Lowering

- Frequency lowering is the umbrella term for the signal processing in hearing aids that makes high-frequency sounds available at lower frequencies, where the patient can hear.

Tinnitus Management

- Tinnitus Sound generator (Resound)
- Tinnitus Masker (Unitron)
- Tinnitus Balance (Phonak)
- Sound Therapy (Signia)

Phone media streaming

- Direct connectivity with iOS®, Android™, or virtually any other Bluetooth® phones for Calls and Media
- Hearing aids aces as ear pods
- Virto Black (latest from phonak)

Rechargeable Solutions

- Li-ion batteries:
  - 3 hours of charge
  - 24 hrs of backup
  - Cannot be replaced
  - Longer life
- Silver Zinc batteries :
  - 6-7 hours to charge
  - 15 hours of backup
  - Regular Zinc air disposable batteries can be used
  - Doesn't last long

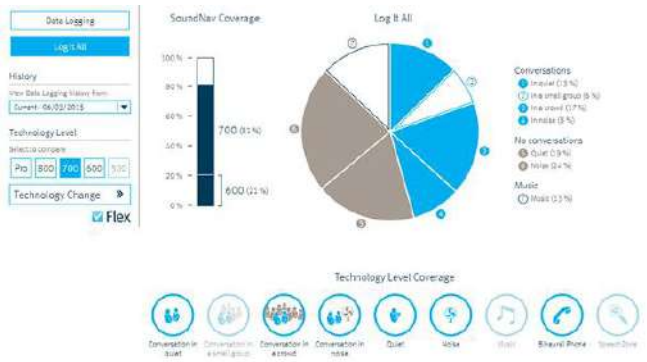
Smartphone app control:

Data logging

- Shows the number of hours of usage
- Environments where hearing aids were used
- Suggests if present technology suits hearing aid user's need

Impulse noise reduction

- Eliminates discomfort caused by sudden impulse noises
- without completely removing the sounds or making them unrecognizable
- Improves listening comfort
- Preserves speech comfort and clarity.



Fitness tracker

- Like wristbands and watches to monitor heart rate and steps taken, Livio AI by Starkey monitor physical activity as well as vital signs like body temperature and blood pressure.

Fall detector

- When hearing aid detects fall, it auto alerts to the SOS contacts.

Connectivity

The Ashtavakra

ASHTAVAKRA

TRAINING & PLACEMENT

Get TRAINED » Get HIRED

Our Training Partners:

1. Starkey Hearing Foundation
2. CRPF School, Sec-14, Rohini
3. Chahat Special School, J11/45, Rajouri Garden
4. J. D. Tytler Learning Centre, Ajmal Khan Park
5. Early Riser Special School, Shahdara
6. Pt. Deendayal Upadhyaya Institute for the Physically Handicapped
7. Saksham Rehabilitation and Research Centre, Kanjhawala
8. Parvarish Special School, Satyam Enclave, near Mother Dairy, Jhilmil
9. Parivartan Special School, Block K-II Vasant Kunj
10. Kaalam - An Initiative Malviya Nagar
11. Asha Kiran, Home for Mentally Challenged, Department of Social Welfare, Govt. of NCT of Delhi, Rohini
12. School for Mentally Retarded Children, Department of Social Welfare, Govt. of NCT, Mayur Vihar, Phase-1
13. The New Learning Height Special School and Remedial Centre, Dwarka, Block-G Raja Puri
14. Maxwell Institute for the Special TPDDL Office B124/1 Lakhi Ram Park, Opposite Sec-22 Rohini
15. The Special School, Sec-24, Rohini
16. Manovikas Charitable Society, 60A, Swami Dayanand Marg, Radhey Puri Extn.
17. Rajkiye Sarvodaya Vidhyalaya, Roop Nagar, No. 4
18. Govt. Boys and Blind Senior Secondary School Guru Teg Bahadur Nagar
19. Govt. Senior Secondary School Blind, Kingsway Camp
20. Govt. Boys Senior Secondary School, Sarai Rohilla
21. Govt. Boys Senior Secondary School, Padam Nagar
22. Govt. Boys Senior Secondary School, Kinari Bazaar
23. Govt. Boys Senior Secondary School, Idgah Road
24. Govt. Girls Senior Secondary School, Deputy Ganj
25. Asha Kiran Complex, Sec-1, Rohini
26. GSSSBB, Sewa Kutir Complex, Kingsway Camp

Internship

ALL INDIA INSTITUTE OF SPEECH & HEARING, MYSURU

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AYJNISHD(D)

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