Aural Habilitation in Severe to Profound Hearing Impaired Children Below 2 years

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Introduction :

Education of deaf children began in Europe about three centuries ago by Jacob Perei (1715-1780) ,and it was established in the United State by Thomas Gallaudet (1781-1815) .New methods of aural habilitation dates back to the last two decades .[1] Early detection of hearing loss in children has began about 60 years ago . [1-8]

The main goal of early detection of hearing impairment in children is early intervention . There is a strong belief that early intervention results in oral language development . Although there is a growing serious interest in early detection of hearing impairment in developing countries , but pilot studies are necessary in this country to provide empirical data that will guide healthcare providers who wish to intricate a programme at any level of healthcare delivery[2] .

In Iran, deaf education by means of sign language began a bout 80 years ago , but new methods of aural habilitation dates back to the last decade . The other choice for a deaf child is cochlear implant, but is not available for every case . As aural habilitation is being done in sporadic non organized style , many pilot studies are needed to evaluate how are previous method , sign language , can be substituted by oral language in Persian. Like other countries , such as Sweden , a lot of work should be done on improving and developing efficient and individualized auditory speech training and its assessment method [3]

Language acquisition is very complicated . The complexity of learning a language arises from a synthesis of the many influences and activities that enable a child to become linguistically engaged . Children learn language by developing and assembling together four systems of skills . The pragmatic , phonology , semantic and syntax are separate but inter related systems that comprise the foundation of language acquisition (Rescorla and Mirak 1997) [4]. Except for the semantic system , acquisition of each of these systems is subject to a critical period after which full mastery of language is unlikely (Crystal 1998 ; Hurford , 1991 ; Lenneberg 1967) [5] . Studies on speech perception and speech production of profoundly deaf children after cochlear implant inform us about the developmental plasticity of the auditory system [6] . In the first year of life , the neurons in the auditory brain stem are maturing , and billions of major neural connections are being formed . During this time , the auditory brain stem and thalamus are just beginning to

connect to the auditory cortex [7] . The neurons in the cortex mature during the first 3 years of life , and after that the brain's general organization dose not change significantly [8] . Unfortunately , the delay in exposure to appropriate language models is often reflected in poor language outcomes (Itano 2000) [9] . Consequently , most hearing impaired children often evidence significant departures in acquisition of the system of skills needed to develop language optimally [10] .The degree of language development skills of the hearing children can be tested by means of mean length utterance . . [11] oral language acquisition is highly dependent upon what the deaf child can hear , hence , appropriate amplification and cochlear implants , provide deaf children with a means of accessing the auditory information that are essential for language development [12-13] . Speech intelligibility is one of the important feature of spoken language development in sever to profound hearing- impaired child .Intelligibility refers here to " the degree to which the speaker's intended message is recovered by the listener"(Kent , Weismer,Kent , & Rosenbeck ,1989)[14] or "the comprehensibility of the specifically linguistic information encoded by a speaker's utterances"(Samar & Metz ,1991) .. [15] Measuring speech intelligibility , however , is problematic because intelligibility metrics are affected by a number of factors , including articulation / phonological aspects , super segmental factors , contextual , and semantic / morphologic / syntactic feature [16-17] . We fallow these children and will discuss about their speech intelligibility in another article .

On the other hand mean length utterance can be traced at the level of morpheme and word [18] .MLU develops in spoken language and also sign language of deaf children [19]

Within this project we have been discussing the following questions :

Do severe to profound hearing- impaired children develop spoken language ? Does spoken language of these children show enough mLU development is language development in sever to profound hearing impaired children comparable with normal hearing children ? And does our early intervention provide hearing-impaired child to take part in non-inclusive schools ?

Therefore , the main purpose of this study was to examine one of the language skills mean length utterance , in sever to profound hearing impaired children received aural habilitation at a very young age (mean age 17 months) and then to compare the result with normal hearing children at the same age (4 -4.5 years) .

Methods :

Subjects : Nine sever to profound hearing impaired children , out of the primer 42 cases , who were detected below two years old were selected for the study to receive aural habilitation .Among 42 cases , 5 children had visual impairment

and cerebral palsy who were excluded . In the rest 37 children only 9 cases could stay with us for 2-3 years . Their mean average hearing thresholds was (78.8 dB). The mean age at the beginning of auditory habilitation was 17 months (age range 7-24 months) . [Table 1]
Two children (case 3 and 6) had no measurable unaided hearing above 2000 HZ in the left ear , but about 90 dB HL in right . All children were programmed in the continuous auditory training by Erber method for one session per week (45 minutes) . They receive speech therapy for 45 minutes a week after beginning the speech production . program optimization and auditory language growth was monitored on a routine basis by the video tape recording and regular reports from therapist and parents , in conjunction with recording their free and elicited speech at age 4 -4.5 year, then they were compared with matched normal hearing children at the same socio-economic status . All children had normal intelligence and cooperative parents . workshops for parents , therapists and educators were presented by the department of Deaf Education of Social Welfare Rehabilitation University on auditory - aural enhancement techniques to facilitate oral language learning . Since mainstream schools are auditory - verbal environments , we put them in the non - inclusive kindergarden from 3.5-4 years old .

Test Procedure :

The procedure that can asses one of the aspects of language skills such as mean length utterance was designed . Testing was performed via each child's preferred mode of communication : either total communication (sign Persian system plus speech and audition) or oral communication (audition , speech and lip-reading) . Although the auditory perception and speech production in these children were monitored by video tape recording every 3 - 6 months up to 4 years , but the mentioned test procedure was done at age 4-4 . 5 years. We recorded 50 utterances of these children during free playing and also their descriptive utterances of 4 pictures, then it was analayzed at morpheme and word level .These score were compared with mean length utterance of 27 matched normal hearing children at the same age who attended the center for young children , a day - care facility for children of welfare organization . Children were recruited by letters to parents requesting their children's participation as member of a comparison group in a study examining the " development of speech " of children with hearing impairments . In the first part of the study at age 4-4.5 MLU score showed considerable differences between hearing impaired and normal hearing children in MLUm ,but not MLUw.

Results : 14

For the 9 children with sever to profound hearing impairment ,MLUw ranged from 1 to 5 by age 4 -4.5year MLUm was 3 to 4 (table 1), while that , these scores for 27 normal hearing children were recorded 3 to 5 by age 4 -4.5 at the morpheme and 4 to 5 at the word level .Minimum of MLUm was 4.88,and maximum was scored 8.84 ,this score in MLUw was minimum=2/08 and maximum=4/7 (table 2)

In the studied group , the mean of MLUw was 3.11 (SD=1.36) and MLUm was 3.66 (SD=0.5) .In control group mean MLUw was 4 (SD=0/55)and MLUm=7.1(SD= 0/98) (Table 3)

Discussion :

In this study , MLU , as one of the aspects of language skills , in 9 sever to profound prelingualy hearing impaired children was investigated .

First we probe this aspect among these hearing impaired children and compared the results with each other , then in the second part of the study , we compared this with matched normal hearing children .

The first part of the study shows that MLU growth in this group was not the same and was effected by several factors . summarizing these factors we conclude that:

1- in profound group auditory perception and language growth , in the first year of auditory training was not the same . case 2 showed very slow growth rate . His behavioral disorder conduct us to consult with Psychologist who suggested an attention deficit hyper activity disorder in this case . ADHD and probably accompanied central auditory processing disorder are two of the affecting factors in auditory , speech and language growth which give the range and over lap of performance profiles and etiologies covered by these labies (ASHA 1996) [20]

After supervising of the psychologist for more than one year and better management of ADHD in case 2 , his language development became better than case 1 . we related this to better functional hearing of case 2 in compare with case 1 in spite of nearly equal pure tone average in 5,1,2 KHz . The influence of sensitivity (degree of loss) and frequency range (configuration) will represent the most reliable audiometric information . The disorders of fidelity and other factors that are less precise reduce a clinician's ability to predict the handicap from the pure tone information . The audiologist and the client will be best served when all of the available information is used . By doing this , the audiologist may be to make general statements about the person's hearing function and probable needs [21].

2- MLU in case 5&8 whose thresholds were about 70dB was lower than other five cases (3,4,6,7,9) in spite of their better hearing . These two children had more than five attacks of serous otitis media per year .

They probably couldn't receive some acoustic information . Their language development was more impeded by this function in their hearing threshold . Skinner in 1978 listed a number of detrimental " acoustic liabilities " to a child's language learning when a hearing loss exists . one of them was lack of consistancy of auditory clues when acoustic information fluctuates. [22]

3- In case 3&6 language skills , were consistently superior to the rest sever hearing- impaired children (case 4,5,7,8,9), in all aspects and at all age levels . their medical history showed that they lost their hearing gradually and around their first birthday . Lennenberg (1967) stated that those who lose hearing after having been exposed to the experience of speech , even for as a short period as 1 year, can be trained much more easily in all language arts , even if formal training begins some years after they had become deaf [23].

In the second part of the study we compared them with normal hearing children . Direct comparisons with the high literature are not possible because the development delays of what would now be termed identified were too low to report developmental ages for the birth through live year old population (Itano 2003) [24]..

As mentioned before , we didn't have access to hearing impaired children younger than 6 months and our studied group was chosen below 2 years old . So the other pilot studies are needed in younger hearing impaired children to support this study and conduct us in revising our early intervention methods for hearing impaired children . Our other recomment is that the different aspect of language development be investigated by other studies .

Conclusion :

Severe to profound hearing impaired children who receive aural habilitation acquisit oral language but not in the same level . Each case needs individual planning . Although MLU w in this group showed relative delay in compare with normal hearing children , but was acceptable in severe hearing impaired children .whife MLUM in normal hearing showed a considerable differences with hearing impaired . All in all severe group was more comparable with normal hearing one and had a chance to take part in non - inclusive schools , but profound group are probable candidate for inclusive schools .

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Table 1 ; Descriptive status of the Studied Group snd MLU Analyses

	Gender	Age months	Hearing Loss	MLUw	MLUm
Case 1	F	21	90	4	4
Case 2	M	18	90	1	3
Case 3	M	21	80	5	4
Case 4	F	7	70	3	4
Case 5	F	18	70	2	3
Case 6	M	20	80	5	4
Case 7	F	12	80	3	4
Case 8	M	24	70	2	3
Case 9	F	12	80	3	4

Table 2 .MLU Analyses of the Control Group

M L U	Number	Min	Max	Mean	SD
MLUm	27	4/88	8/84	7/1	0/98
MLUw	27	2/08	4/7	4	0/55

Table 3: MLU Analyses al the ytlldied Group

M L U	Number	Min	Max	Mean	SD
MLUm	9	3	4	3/66	0/5
MLUw	9	1	5	3/11	1/36

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Reference :

1- Hull RH .What Is Aaural Rehabilitation? Aural habilitation .3rd ed .San Diego, London ;Singular publishing, INC . 1997 ; 1-18
2-Olusanga BO , Luxon L M ,Wirz S L . Benefits and challenges of newborn hearing screening for developing countries. Int j Pediatr Otorhinolaryngol .2004 Mar;68 (3) :287_305
3-Borg E, Risberg A,AllisterB C, Undemar B M ,et all .language development in - hearing -impaired children ,LATH IC . International journal of pediatric otolaryngology . 2002 . (65) : 15-26
4-Rescorla L ,Mirak J .Normal Language Acquisition .Semin Pediatr Neurol 1997; 4: 70-76 .
5- Crystal D . The Cambridge encyclopedia of the English language , 2nd ed . Cambridge university press .
6- Robinson K . Implications of developmental plasticity for the language acquisition of deaf children with cochlear Implants .Int j pediatr otorhinolaryngol 1998 Nov 15 ; 46 (1-2) : 71-80
7- Sininger Y S ,Doyle K J ,Moore J K . The case for early identification of hearing loss in children . Auditory system development ,experimental auditory deprivation ,and development ,of speech perception and hearing . Pediatr Clin North Am 1999 Feb ;46 (1) : 1-14
8-Northern JL .Auditory Development .In Hearing in children .fifth ed .Baltimor,Maryland ,USA , Lippincott Williams &Wilkins 2002,p :127-157
9- Yoshinaga Itono ,C., Assessment and Intervention With Preschool Children Who Are Deaf and Hard of Hearing In.Rehabilitative Audiology . Alpiner J G & Mc Carthy.P A (eds),3rd ed ,United States of America Lippincott William &Wilkins ,2000 ,p :140-177
10- Mellon NK . Language Acquisition ,Niparco JK,Mellon NK,(eds).in cochlear implant,Philadelphia ..William &Wilkins 2000 .p291 -314
11-Chabons , Kent - Udolf L, Egolf DB, TheTemporal Reliability of Brown 's Mean Length of Utterance (MLU) Measure with post -stage v children ,j Speech Hear Res , 1982,25 (1),24-8.
12-Priscilla M. Bollard ED D ,Patricia M . et al .Specific Language Growth in Young Children Using the Clariton Cochlear Implant .Ann Otol Rhinol Laryngol .vol 108 :1999 No 4 part 2 .
13- Patricia G ,Stelmachowie Z ,Hoover D E ,et al .The Relation Between Stimulus contex ,Speech Audibility , and Perception for Normal -Hearing and

Hearing Impaired Children . journal of speech ,language ,and Hearing Research . vol 43 ,August 2000
14- Kent,R.D.,Weismer,G.,Kent,J.F.,& Rosenbeck.Toward Phonetic IntelligibilityTesting of Dysartheria , journal of Speech and Hearing Disorder , 1989 ,54; p :482-499 .
15-Samar ,V.J.,& Metz , D .E .Scaling and transcription measures of intelligibility for populations with disordered speech :Where's the beef ? journal of Speech and Hearing Research ,1991,34, p:699-704
16- Brannan,M G .,Hodson B.W ., Intelligibility / Severity Measurements of Pre kindergarten children,s speech . available at http:// www.asha. Org access 2005
17- Kent ,R.D .,Miolo ,G., & Blocdel, S ., The intelligibility of children's speech :A review of evaluation procedures . American journal of Speech -Language Pathology , 1994 ,3 (2) , p: 81-95
"18-Matthew D.Parker.Kent Brorson . A comparative study between mean length of utterance in morphemes (MLUm) and mean length of utterance in words (MLUw). First language. 2005 ,voi,25, no (3);365-376
19- Klatter J,Folmer and et all .Language development in deaf children 's interactions with deaf and hearing adults A dutch longitudinal study .J of deaf studies and deaf education .feb ,2006,11 (2) ;238-251
20-Oster A- M ,The relation between residual hearing and speech intelligibility. Is there a measure that could predict a prelingually profoundly deaf child's possibility to develop intelligible speech ? available at www.speech.Kth.sc/q psr/tmh/2002/02-43-051-056
21-Chermak ,G. D.,Musick, F.E., Central Auditory Processing Disorders…….San Diego,London;Singular publishing Group Inc.1997 ; p 1-25
22-Katz,J.,White,T.P.,Introduction to the Handicap of Hearing Impairment. In Aural Rehabilitation-Hull,R.H (eds),3rd ed , SanDiego ,London ;Singular publishing Group .Inc ,1997;p;19-36
23-Northern,J.L.,Hearing and Hearing Loss in Children ,In Hearing in Children , Fifth ed .Baltimore,Maryland ,USA , Lippincott.Williams & Wilkins ,2002 , p:1-31
24-Northern,J.L.,Hearing and Auditory Development and Early Intervention ,In Hearing in Children, Fifth ed. Baltimore, Maryland ,USA ,Lippincott.Williams & Wilkins ,2002 ,p:127-157
25-Itano ,Y.C.,Early Intervention after Universl Neonatal Hearing Screening Impact Outcomes ,Ment Retard Dev Disabil Res Rev,2003,9 (4) p:252-66