INFANT AUDIOMETRY: REVIEW OF LITERATURE 1989-95: COMPARISON OF METHODOLOGY

AN INDEPENDENT PROJECT SUBMITTED IN PART
FULFILLMENT FOR THE FIRST YEAR MASTER'S DEGREE
IN SPEECH AND HEARING TO THE UNIVERSITY OF MYSORE

REG- NO. M-9506

ALL INDIA INSTITUTE OF SPEECH AND HEARING
MYSORE-570 006
INDIA

1996

DEDICATED TO

THATHA, AMMA, ANNA, SUDHA AND SATISH

CERTIFICATE

This is to certify that this Independent Project entltled ***"INFANT AUDIOMETRY:*** **REVIEW** ***OF LITERATURE 1989-95:*** **COMPARISON** ***OF*** **METHODOLOGY"** *is the bonafide work, done in part fulfillment for the first year of the Master's Degree in Speech and Hearing of the student with Gegistration No.* M-9506.

Mysore

May'96

DR. (MISS) S. NIKAM
Director
All India lnstitute of
Speech and Hearing
Mysore-570 006

CERTIFICATE

This is to certify that this Independent Project entltled **"INFANT AUDIOMETRY: REVIEW OF LITERATURE 1989-95: COMPARISON *Of METHODOLOGY"*** *has been prepared under my supervision and guidance.*

Mysore

May'9 6

Dr. (Miss) S. NIKAM
GUIDE
All India Institute, of Speech and Hearing
Mysore-570 006

DECLARATION

I *hereby declare that this Independent Project entitled* **"INFANT AUDIOMETRY: REVIEW OF LITERATURE 1986-95: COMPARISON OF METHOPOLOGY** *is the result of my own study undertaken under the guidance of* ***"Dr.*** **(Miss) S. Nikam,** *Director, All India Institute of Speech Hearing, Mysore, and has not* bee *submitted earlier at any University for any other diploma or Degree.*

Mysore

May'96 Reg.*No. M-9506*

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ABBREVIATIONS I

R	-	Review
E	-	Experiment
CS	-	Case study
N/abn	-	Normal/abnormal
D/S	-	Diagnosis/screening
HRR	-	High risk register
BOA	-	Behaviour observation audiometry
COG	-	Crib-O-Gram
VRA	-	Visual reinforcement audiometry
IT/R	-	Immittance: Tymphanometry/Reflex
PTA	-	Pure tone audiometry
BSERA	-	Brain stem evoke response audiometry
E_c	-	Electrocochleogram
R_e	-	Reflectometry
OAE	-	Respiratory audiometry
C/TB	-	Clicks/tonebursts

ABBREVIATIONS II

Journals

Aud - Audiology

Sc A. d - Scandinavian audiology

BJA - British Journal of Audiology

JSHR - Journal of Speech and Hearing Research

E & H - Ear and hearing

VR - Volta review

Acta 0 - Actaotolaryngologica

Annals of R & 0 - Annals of rhinology and otology

CONTENTS

INTRODUCTION

TO

REVIEW OF LITERATURE

"The Ear is the Organ of Education"

- Aristotle

Early childhood is the fiery crucible in which we become molded into the essentials that we forever will be. Hearing plays a very important role in understanding how to utilize this crucible. It also becomes doubly important that we understand how to utilize this in case of children who are not gifted with the ability of sensitivity to sounds.

A hearing defect either congenital or acquired early in life can interfere with the development of concepts that culminate in normal speech and language. For a variety of reasons, many children with abnormal hearing proceed into the third year of life or beyond before a hearing problem is suspected.

Surely the earliest possible identification of a hearing defect is crucial. The earlier in the life of the child that aural habitative measures can be applied the greater are the chances for the successful development of speech communication.

Early identification and implications

"The infant learns to listen in order that he may listen to learn"

Zigmond and Cicci (1968)

This statement stresses the importance of hearing in ones life.

Early identification of hearing loss within the first year of life or two is a must so that its effects may be diminished to a certain degree and that he may mature to a full role in the society.

According to Ewing, the development of auditory behaviour is considered as one of the total aspect of the experience of the child hence early identification is necessary as it also leads to intervention and rehabilitation.

The audiologist plays a very important role in early identification. Asha (1975) states that the responsibilities of an audiologist as "The basic responsibility for social function of hearing, assesses the practical usefulness of auditory capacity and undertakes to increase the ability of the hearing handicapped individual to cope with the situations of everyday life.

A basic problem that arises when it comes to fulfilling these duties is the matter of assessment or testing, in infants especially as we have less number of standardised tests for infants and children when compared to adults.

Recent research in this area has revealed fruitful results with discovery of brain stem evoked response, otoacoustic emissions, etc. Apart from these there are also a few traditional methods such as behavioural audiometry, visual reinforcement audiometry, high risk registers, etc. which even though are subjective were commonly used a few years ago.

When audiological evaluation came into use psycho-physical testing was limited in its scope and procedure and not all infants could be tested due to one reason or the other. This led inevitably to the loss of the so called critical period (by Lenneberg) or sensitivity period (Greenstein) which is the most important stage of any child's life.

However, several interesting inventions have come up in the field of audiology including testing procedures, the most recent ones as mentioned earlier being ABR and OAE. These make the clinicians' job more easy, objective, accurate and are relatively less time consuming than the previously used methods.

As mentioned earlier it is more difficult to test children because they are in that stage where they are just learning and even a competent audiologist might be misled by some responses from the child which may not exactly be evoked by acoustic stimuli. Hence it might be highly frustrating.

Another factor to be considered is testing of children with associated abnormalities such as mental retardation, cerebral palsy, along with hearing loss. Identification in these cases is further complicated as the child prevents a confusing clinical picture.

It should also be noted that the recent trend in testing is towards non-invasive techniques, which requires minimum participation from the child being tested. Thus hearing handicap being one of the few handicaps that has serious consequences in terms of intellectual speech and language, . It is necessary to have knowledge regarding the commonly used procedure to screen or diagnose hearing loss especially in infants.

Some of these tests are:

1. **High risk register** - This concept assumes that one can identify a small group of children whose history or physical condition identifies them as possessing a high chance of having the target handicap, as in this case hearing loss.

2. **Behavioural observation audiometry** is a most commonly used procedure with infants and young children. Here the response to a particular sound is noted. This

response could be anything including startle, eye blink, smile, limb movement, etc.

3. **Visual reinforcement audiometry** is a conditioning procedure used with children above six months and below three year of age. Here classical conditioning is used to condition the orientation response, and threshold levels are identified.

4. **Crib-O-Gram:** It is a movement sensitive transducer where-in any movement by the baby is converted to electrical impulse which gets noted on the graph.

5. **Reflectometry** is a hand held instrument which helps in screening for otitis media.

6. **Physiological hearing tests** that are commonly used are heart rate audiometry, respiration audiometry, brain stem evoke response audiometry, impedance audiometry, electrocochleography and otoacoustic emissions.

Of the above heart rate and respiratory audiometry measures the change in heart rate and respiration respectively, when an acoustic stimulus is presented. These can be used both for screening and diagnosis of hearing sensitivity.

7. Impedance: This is a technique for evaluating the physiological function of middle ear system and is extremely sensitive between normal and pathological ears. More

elaborate evaluation of stapedial reflex will give information regarding sensory neural hearing sensitivity. This test battery includes tympanometry, physical volume test, acoustic reflex determination.

Brain stem evoke response audiometry

This is a non-invasive procedure which involves average of encephalic responses to acoustic stimulus. It has give waves picked up from different nucleus of the auditory pathway. It is a reliable screening as well as diagnostic procedure.

Otoacoustic emission

This is a non-invasive procedure where the sound reflected from the cochlea by the hair cells are picked up and used to assess the hearing sensitivity.

Thus having outlined the necessity of early identification, the consequences of not doing so and the possible procedures that can be used in identifying infants who have reduced hearing sensitivity we will further proceed to explore the purpose of this study on infant audiometry.

Purpose of the study

- To locate the most commonly used procedure in audiological assessment of infants.

- To compare methodology used in the 1980s with that used in 1990s.

- To know the advantages of the recently used procedures and new modifications within these tests to increase their sensitivity and specificity.

- To list out the subject variables used in the studies and their comparison with previously used studies.

METHODOLOGY

Article selection

All the articles selected in this study have been published between 1989 to 1995. The articles available in the catalogue of library and information centre have been made use of in this project.

Subjects

Only those articles have been selected where in the age of the subjects fall between 0-3 years.

Type of pathology

Articles dealing with both middle ear and inner ear pathologies have been taken in this study.

Analysis of these 60 articles collected has been done in a tabular column where in the information obtained has been divided into

a. Serial number

b. Authors year

c. Journal/volume (number)

d. Type of study: (1) review, (2) experimentation, (3) case study

e. Subject variables: (1) age/sex, (2) normal/ abnormal, (3) number of subjects

f. Purpose of article diagnostic or screening

g. Type of procedure used

h. Stimulus variables, frequency, intensity, type of stimulus

i. Conclusion drawn from all these articles

51. No. *Author/year*	*Journal/ Vol.* No.	*Type of study* R. *E CS*	Subject variables				Procedure											Stimulus variables			Conclusion
			Age/sex	*N/abn.*	*Number* of *sub*	*D/S*	fHRR	BOA	COG	VRA	Lmm *T/R*	*PTA*	BSERA	Ec	*Re*	*RA*	*OAE*	Intensity	Freq-ency *(Hz)*	C/TB	
1 *tick*, M.R. et *al.* *1990*	*Aud 31(3)*	***X***	*3hr-1d*	*N*		*S*						**X**				**X**			*40Hz study state*		Failing of OAE in first 24 hours can pass if retested *1 day later due to increased* impedance
2 *Maurizie, M. et al.* 1990	*Aud 29(6)*	*E*	*New born 5-8 yr*	*N*	*32 10*	*D*															New borns respond *around 50-30 dB* M. Results stabilise *with age*
3 Sasema, P. 1990	*Aud V29(2)*	*E*	*GI<16n GII 9-35 yr*	*B*	*1-42* 75	*B*	**X**					**X**									
4 *Zwicker, E. et al.* *1990*	*Aud 29(5)*	*E*	*8d-8 yr*	*B*	*5*	*S*													*1.5 kHz* evoker		
5 Holte *Lenore et al.* *1991*	Aud *32*	*x*	*<6 m n*	*N*	*23*	*S*					lym.										*Admittance increases with* age above 225 Hz

Sl. No. Author/year	Journal/ Vol. No.	Type of study R E CS	Subject variables Age/sex	N/abn.	Number of sub	D/S	Procedure HRR BOA COG VRA Im. T/R FIA BSERA Ec He HA DAE	Stimulus variables Intensity	Freq-ency (Hz)	C/TB	Conclusion
6 Helen, S. et al. 1993	Aud 34(2)	**X**	2A mans	WE path	593	S	Tym				Type B tympanogram
7 Spivak, L.G. 1995	Aud 34,(3)		3-238 hr	N	1036 infants 71 adults	S	**X**		Inf 70 dBnHL adu 30 dB nHL		Greater. % of low information in infants. Thus a low pass filter enhances detectability of wave V
8 Yang Edward 1993	Aud 34(1)	**X**	38-42 wk	N	20	S	15-30 dBnHL		15-30 dB		ABR to BC clicks are available, as ABR to AC clicks
9 Kok, M.R. et al. 1994	Aud 33(3)	**X**	Ward 30-49 W OutPA	B		S		**X**			Very IBW cases are difficult to test especially in outpatient ward
10 Kok, M.R. et al. 1994	Aud 33(4}	E	3-238 hr/ NM	N	1036 inf. 71 adults	5	CEOAE				Overall prevalence of EOAE is 93.4%, 78% in < 36 hours 99% in < 108 hours Therefore screening should be done after four days

Sl. No.	Author/year	Journal/ Vol. No.	Type of study: R	E	CS	Subject variables: Age/sex	N/abn.	Number of sub	D/S	Procedure: HRR	BOA	COG	VRA	Imm. T/R	PTA	BSERA	Ec	He	KA	OAE	Stimulus variables: Intensity	Freq-ency (Hz)	C/TB	Conclusion
11	Primus, M.A. 1994	Aud 33(4)		E		8-12 mon/ both	N		D				x											Maximum response at 4 sec correction factor for prediction of behavioural threshold from ABR in both healthy and ME effusion is proposed
12	Einan et al. 1989	Sc aud VA (4)		E		2m-16yr/ both	N		D					x		x						2-4 kHz		
13	Fjermedal et al 1989	Sc Aud 18(2)		x		Multiple and other disorders	142	S	x							x								Parental evaluation had high false negative value. Children with hearing loss had correlation bewteen BOA and ABR than neonatal children
14	Geda Hiromi 1990	Sc Aud V 20(1)		E		36-44w/ both	N	118	D							x						Clicks		
15	Johnsen, N.J. et al. 1993	Sc Aud V 23(1)		E		Fulterm both	N	20	S							x					70,50,20dB attenuation	Click at 2 kHz		A definite response at 50 dB attenuation in all ear

Sl. No. Author/year	Journal/ Vol. No.	Type of study R E CS	Subject variables Age/sex	N/abn.	Number of sub	D/S	Procedure HRR	BOA	COG	VRA I/R	Immittance	PTA	BSERA	Ec	Re	RA	O/1B	Stimulus variables 'intensity	Freq-ency (Hz)	CA	Conclusion
16 Mjoen, S. et al. 1993	Sc Aud V 23(l)	E	Birth-48 hrs/ both	N	20	S						X							2 kHz		1. Wave gradually more marked from 2-40 hours 2. Ratio of V/I was 1.06±0.08
17 Scallop, J.K. et al. 1993	Sc Aud V 23(2)	E	full term/both	N	36	S						X									Piezoelectric earphones constructed with small cone tweeter loud speakers are suited for ABR
18 Boendagle et al. 1994	Sc Aud V 23(4)	E	0-1 yr/ both	Mixed	96 nb 35 fu	S										TEOAE					Suitable screening proceduri and is most successful when performed at 3-4 days .
19 Meredith, R. et al. 1994	Sc Aud V 23(3)	E	0-5 yr/ both	HRB	772	D+S															Sensitivity is good, specificity is poor
20 Olsen, S. et al. 1994	Sc Aud V 23(4)	E	8 yr/ 30th	N		D			X												No advantage of modified over classical method

Sl. No. Author/year	Journal/Vol. No.	Type of study (R E CS)	Subject variables: Age/sex	N/abn.	Number of sub	D/S	Prcedure: HRR	BOA	COG	WM lim. T/R	PIA	BSERM	Ec	Re	HA	OAE	Stimulus variables: Intensity	Freg-ency (Hz)	C/IB	Conclusion
21 Mcnnik, C. et al. 1SS6	Sc Aud V 24(1)	E	5-8 m/ adults/ both	Botti	107 adults 22 infants for MEP	5						X								AC ABR > BCAER in infants with PIE pathology combination of AC and BC ABR gives > inf. regarding cochlear receiver
22 Palmer, A.R. et al. 1991	BJA 25(4)	E	Lower limit-2.4 Upper limit-13.B	N	66	S		Aut. 60 yr									St.to. 72 dB reduced by 12dB			PI results car. be derived from SD scores with a 95% confidence interval of ±11 dB
23 flows, S.T. 1991	BJA 25(4)	E	6 w post delivery (SOBC unit)		HHR	5	X				X						53 dBHL			Delayed screening until the post neonatal stage is a viable alternative to screening neonatal prior to discharge from special care baby unit
24 Stevens, J.C. et al. 1991	BJA 25(3)	E	0-3 m/ NH	Both	723	S										CEOAE	ear- 43 dBnHL 11 ear- 53 dBnHL			CEOAE as a screening tool has a sensitivity of 93% an specificity of 84%
25 Westwoocd, G.F.S. et al 1991	BJA 25(5)	E	0-6 months B	AW	12 chn 10 adults			Probe tube meas-												Mean resonance was nigner 4200 YL than mean adult was = 29500.

SI. No. Author/year	Journal/ Vol. No.	Type of study: R	E	CS	Subject variables: Age/sex	N/abn.	Number of sub	D/S	Procedure: HRR	EOA	COG	VRA	Imm. r/R	PIA	BSERA	Ec	Re	HA	OAE	Stimulus variables: Intensity	Freq-ency (Hz)	C/IB	Conclusion
26 Haggard, M. et al. 1992	BJA V 26(2)				1-4 yr/ both		Both	S															Bus journal gives 10 recommendations in infant screening
27 Shelltrom, P. et al. 1992	BJA V 26(3)		E		<3 yr		NM	D															Recreational toys used are sufficient intense to cause NIHL.
28 Solomon, G. et al. 1932	BJA V 26(3)		E		<3 yr		NM	S											X				24 hours is good for evaluation
29 Douniadakis, D.E. et al. 1990	BJA V 27(7)		E		2d-14yr		Otitis media	S											X				Has good sensitivity and specificity in determining CM. But not sensitive for negative ME pressure or bubbles in ME
30 Fortnum, H. et al. 1993	BJA V 27(6)																						Children with conductive loss after meningitis can be identified with routine referal

Sl. 'No. Author/year	Journal/ Vol. No.	Type of study			fsubject		variables		Procedure											Stimulus variables			Conclusion
		R	E	CS	\Age/sex	N/abn.	Hitter of sub	D/S	HRR	BOA	COG	MM	lmm. T/R	PTA	BSERA	Ec	He	RA	OAE	Intensity	Freg-ency (Hz)	CAB	
31 Maxon, A.B. et al. 1993	V 27(4)	R			24-48 hr	AW	12.000	B											TEOAE				Identifies SN hearing loss and is a potential screening tool for early identification
32 Rioroan, A. et al. 1993	BJA V 27(7)	R				Meningitis	-	S															Children with conductive loss after meningitis can tie identified with routine referal for hearing testing
33 Schorn, K. 1993	BJA V 27(9)		E	C		NM		S											TEOAE				TEQAE is the most useful test and can be treasured within minutes and can be measured by trained workers in nursery
34 Thornton, R.D. et al. 1993	BJA V 27(5)		E		3 days post partun	NM	121	S															Middle ear pressure and degree of obstruction of the ear canal plays a very important role in pass rate
35 Hunter, M.F. et al. 1994	BJA V 28(1)		E		0-2 w	N	217	S							II				±				The two screening in order has a coverage of 90% and specificity of 99%

Sl. No. Autnor/year	Journal/ Vol. No.	Type of study			Subject variables				Procedure											Stimulus variables			
		R	E	CS	Age/sex	N/abn.	Mmber of sub	D/S	HRR	BOA	COG	VRA	Imp. T/R	P/A	ESERA	Ec	Re	RA	OAE	Intensity	Freg- ency (Hz)	C/TB	
36 Rickarde, *F.W. et al.* *1991,*	*BJA V 28(8)*		*E*		Full term	Both	337	S							X								Steady state evoked poten- tials at modulation rates *in* excess of 60 *Hz may be* useful for
37 Gunarson, *A.D. et al.* *1991*	*JSHR V 35(1)*	X			Inf.5-7	NM	*27*	*S*							X								In the task of *binaural* interaction children with early loss different *from* control and show disrupted auditory brain *Stem electo-* physiology
30 Karzo*n, R.G.* *1991*	*JSHR V 35(1)*												T										According to this *when* source of information or test data are incomplete tynphananetric measures may be the primary tasis for *medical* referal. *Each clinician should develop his am criteria*
39 Primus, M.*A.* 1922	*JSHR V 35(3)*	X			*12m*	*NM*	*30*	*D*				*X*											*VRA* response is not contin- gent *on localisation but* variables that *impair it may* degrade performance
40 Primus, MA. 1992	*JSHR V 35(4,-5)*	X			*8-12 m*	*B*	40	*D*	*X*						X								Detection responses occured in the initial 4 *sec of the* test trial and use of 8 sec *test trial yields little gain in performance*

Sl. No.	Author/year	Journal/ Vol. No.	Type of study: R	E	CS	Subject variables: Age/sex	N/abn.	Number of sub	D/S	Procedure: HRR	BOA	COG	VRA	Imm. T/R	PTA	OAE	Ec	He	HA	OAE	Stimulus variables: Intensity	Frequency (Hz)	C/IB	Conclusicn
41	Snanks, J.E. et al. 1992	JSHR V 35(3)	X			6 weeks 6-7 yr	NM							Equl. ear canal volume										Criteria value of $\geq 4\ cm^3$ difference is us identify patent tympenostomy tube
42	Lewis, D.E. et al. 1993	JSHR V 36	X			9m-7y 2 adults	B	36 chn 20 adults	D															By 2 yeras of age the real ear to coupler measure becomes similar for adults and children. Inter-subject variability seen is high
43	Schwartz, D.M. et al. 1989	E&H 10(1)	X			Pre-term infants, male, female - adults	N 2o	20 infants 10 male female adults	S								X							Comparison of WI in adults and infants snows peripheral auditory electro-maturity prolonged I latency indica-tes ME pathology or imnaturity of cochlear VIII nerve
44	Norton, S.J. et al. 1390	E& H 11(1)		x		17 days 30 yrs	N	NM	S											X				EDAE are robust in infants and changes with age due to changes in external and ME acoustics and cochlear wear and tear
45	Primus. M.A. 1990	E&H 11(2)		X		8-11	NM	20	S	X		X												Mean threshold did not shift for operant proceed while for non-operant there was ar. upward

Sl. No.	Author/year	Journal/ Vol. No.	Type of study (ii E D/S)	Age/sex	N/abn.	Number of sub	D/S	Procedure (HRR BOA COG VRA Imm. T/R PTA BSERA EC He RA OAE)	Stimulus variables: Intensity	Frequency (Hz)	C/TB	Collusion
46	Schumachu, R.E. et al. 1990	E&H 11(5) '	X	NM infants with severe respiratory failure		25	D	X				16% failed tearing sensitivity criteria, 45% prolonged I-V latency which on follow up reveal neurological abnormality. Ear III-V latency more probably die to rignt carotid artery or jugular vein ligation
47	Stein, H. et al. 1990	E&H 11(3) x		NICL tobies			S					One of three hearing infants can be identified in a NICU screen
48	Stevens, J.C. et al. 1990	E&H 11(2)	X			723	S	CEOAE				80% infants snowed recorded EOAE and the values were stable upto 3 months. Thus CEOAE is a stable screen
49	Stockard, J.E. et al. 1990	E&H V 11(1)	X	High risk babies, neonatal	B	33 HR 77 normal	D	X				Trancient elevation of ABR of trancient group resembles group with conductive loss and later resenable to ABR
50	Stuart, A. et al. 1990	E&H 11(5)	X	48-72 nrs	Hi	25	D	X				Significant ABR wave V latency shifts were observed with changes in the vibrator placement

Sl. No.	Author/year	Journal/Vol. No.	Type of study			Subject variables				Procedure											Stimulus variables			Conclusion
			R	E	CS	Age/sex	N/abn.	Number of sub	D/S	HRR	BOA	CCG	VRA	lmm. T/R	PTA	BSERA	Ec	Re	RA	DAE	Intensity	Freq-ency (Hz)	C/TB	
51	Yang, E.Y. et al. 1990	E&H 11(1)		X		38-42 w gest. age	M	20	S							xBlc olid?								ABR W latency to BC clicks varies with force snift. It is recamended that the force te controlled and constant
52	Auslander, M.C. et al. 1991	ESH 12(6)		X		9-26 m	B	29	D		X													Localisation talk my allow detection of unilateral oss as slight as 25 dB HL
33	Johnson. S.E. et al. 1991	E&H 12(3)		X		11-3 to 6 m 15-20 to 40 yr	B	26	S															Infants have greater spectral peaks and variabi-lity at >F and resonanode ix difference for both infants and adults so norms are necessary
54	Hzuk, E.W. et al. 1991	E&H 12(5)	X			Birth 6-9 yrs	B	8	5															Extensive implementation of HRR with widespread educa-tion of parents is necessary to make HRR more effective
35	Stapells, D.R. et al. 1995	E&H 16(4)		X		1w-8y	NM	86 inf and chn	D							X								Threshold for ABR to brief tones in notched noise for infants are similar to adults and can be used to establish behavioural threshold

Sl. No. Author/year	Journal/ Vol. No.	Type of study R	E	CS	Subject variables Age/sex	N/abn.	Number of sub	Procedure D/S	HRR	BOA	COG	VRA	Imm. T/R	PTA	BSE	MA	Ec	Re	RA	OAE	Stimulus variables Intensity	Freq- ency (Hz)	C/IB	Conclusion
56 Guilee Custaron 1989	VK V 91(6)	R			6-21/2 NM	Both	-	5																
57 Mencner, L. et al. 1992	V 95(5)	R						S	X					X										Considering the variations in toe world's helath care, screening and follow up identify, those with HL should be universal irrespective of geographical boundry
5B florfiis, P. et al. 1992	Acta 0 V 112(5)		E					D												X				Neonates without EDE have larger DPOAE and these are greater in amplitude than in adults. Thus DPCE and EDE can be used to evaluate the auditory peripheral function in neonates
59 Hyde, H.L. et al. 1991	Acta 0 V 112(2)		X		6w-83 yr m N		713 infants							X										For SN loss of greater than 20 dB at 2-4 kHz the ASi was an accurate test. However it depends on target disorder and test
60 Collett. L. et al. 1390	Annals of CR & L		X		6w-83 yr N	166	S													X				Presence of EOAE and peak in spectrum decreases as threshold of EOAE decreases. This is possibly due to biomechanics and or hair cell loss

ANALYSIS

Table 1

Purpose served by the articles

Sl. No.	Articles	Number	Percentage
1	Total number of articles	60	
2	Number of articles served the purpose of screening	37	61.6
3	Number of articles served the purpose of diagnosis	21	35.0

Table 2

Showing the type of testing

Sl. No.	Articles	Number	Percentage
1	Total number of articles	60	
2	Visual reinforcement audiometry	3	5.0
3	High risk register	6	10.0
4	Behavioural audiometry	6	10.0
5	Crib-o-gram	-	-
6	Pure tone audiometry	3	5.0
7	Impedance audiometry	4	6.0
8	Brain stem evoked responses	18	30.0
9	Electrocochleography	-	-
10	Respiratory audiometry	1	1.0
11	Otoacoustic emission	19	31.6

Table 3

Subject, variables

Sl. No.	Articles	Number	Percentage
1	Total number of articles	60	
2	Total number of articles which use infants	23	38.3
3	Total number of articles which use abnormal infants	10	16.6
4	Number of articles which have used both normals and abnormals	18	30.0
5	Number of articles not mentioned	12	20.0

Table 4

Article variables

Sl. No.	Articles	Number	Percentage
1	Total number of articles	60	
2	Number which have used experimentation	52	86.6
3	Number of articles which have used case studies	7	11.6
4	Number of articles which have used review	1	1.0

RESULTS

The following results can be drawn from above:

Total number of articles in the study	-	60
Out of this 37 have undertaken screening	-	61.6%
and 21 have undertaken diagnosis	-	35%
The most commonly used procedure is otoacoustic emission in 19 articles	-	31.6%
Followed by Brain stem evoked response in 18	-	30%

The subject variables as listed in Table 3 involves

Number of articles dealing with normals	-	23 (38.3%)
Number of articles dealing with abnormals	-	10 (16.66%)
Number of articles with both	-	18 (30%)
and those which have not mentioned	-	12 (20%)
Around 52 articles are experimental in nature	-	86.6%
While 7 are single case studies	-	11.6%
and 1 is a review	-	1%

CONCLUSION

Knowledge regarding the different infant audiometric procedures is essential to all audiologists. Extensive usage of otoacoustic emission and brain stem evoked response audiometry have been observed in the current study. This is in keeping with the previous review (1985-89). However, the use of otoacoustic emission has tended to predominate the scenario. A similar situation has also been found in paediatric and adult audiology.

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