TUTORIAL 4

NEURO DEVELOPMENTAL ASSESSMENT

Overall objective

1. The student should be able to perform a neuro-developmental assessment on all children i.e hearing and vision, gross motor & fine motor, language & speech, performance assessment, personal & social assessments.
2. At the end of this examination student should be able to make an assessment about the aproximate age at which the child is functioning and if that is equal or less than the other children of the same age.

Ask the following questions to caregiver when doing neurodevelopmental assessment and proceed with the examination

- Is your child able to see?
- Is your child able to hear and communicate as other children of the same age?
- Is your child doing the same things as the other children of the same age?

PHYSICAL

Vision

- Optical blink
- Menace response
- Follow light , tracking
- Can count fingers

Hearing

- Accoustic blink
- Turn to sound
- Rinnie's & Webber's tests in children >4 yrs old

Gross motor

- Sitting and crawling
- Standing, and walking
- Running – up and down stairs, tendom walking (forward, backward), kicking a ball

Fine motor

- Palmer grasp, reaching for objects
- Pincer grip, handedness, scribbles, writing, geomatrical figures
- Feeding / dressing

INTELLECTUAL

Language

Expresive: being able to produce speech and communicate a message

Comprehension	1 yr, 1 word
Expression	2 yrs, 2 words sentence
Articulation	3 yrs, 3 words sentence

Receptive: being able to follow a series of commands (listening and understanding what is communicated) i.e. responds to name like give me a toy, give me a brush

Speech: Babbles, coos, do distraction test, check if say words, phrases or sentences and ask for name, age, color etc.

Performance assessment

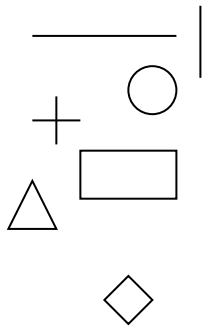
Basic concepts: objective performance 6-12 months

Take a cup and marble – retreive marble from under the cup

Motor constructive: bricks and blocks building >1 yr

Perceptual motor: geomatric designs > 2 yrs

- ± 2 yrs stright line
- ± 2.5 yrs – vertical line
- ± 3 yrs – round circle
- ± 4 yrs – cross
- ± 4 ½ yrs – rectangle
- ± 5 yrs - cross like multiplication
- ± 5 ½ yrs - triangle
- ± 6 yrs – diamond

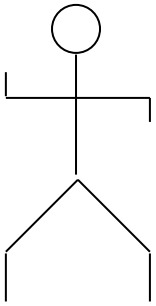


Draw a man test – good enough test

Total of five items or body parts where each scores 3/12. Add this total score to a basic age of 3yrs to obtain developmental age as follows:

- Head 3/12
- Neck 3/12
- Arms 3/12
- Spine 3/12
- Legs 3/12

Developmental age: 15/12 + 3 = 5/4 + 3 = 17/4 = 4 3/12



PERSONNEL / SOCIAL

- Face regard, responsive smile, response to images, stranger anxiety
- Feeding, drinking by holding a cup, exchanging
- Dressing up with help, alone
- Plays peak a boo
- Co-operative play - plays together
- Parallel play – plays alone – along side each other

NEURODEVELOPMENTAL MILESTONES ACCORDING TO THE AGE

AGE	VISION & HEARING	GROSS MOTOR CONGNITIVE	FINE MOTOR	SPEECH & LANGUAGE	PERSONAL / SOCIAL	WARNING SIGNS
New Born	Closes eyes to sudden bright light Still to sounds	Ventral suspension Head droops Hips flaxed Limbs hang Moro + Palmer grasp +	Fisted hands	Startles to sudden loud sound	Alternates between drowsiness and alert wakefulness	Increased or decreased tone Asymetry Sever head lag Poor suck
Screening 6 weeks	Follows Stares Red reflex Pupillary reactions Rattle or bell	Some head control Prone (pelvis up), Moro + Ventral suspension (head up, hips extension)	Keeps hands open 50% of the time	Startles - on history	Smiles Turn to face	Not fixing or following Asymetry Floppy Not smiling Poor sucking No response
3 months	Follows through 180 degree Turns head towards sounds	Pull to sit – no head lag Prone: rise on elbows Rolls over	Holds rattle Hands open Watches hands Pulls at clothes	Coos (sound like a pigeon) Chuckles Laugh quitely	Responds to bottle Excited when fed	
6 months		Prone (extends arms, lifts chest) Pull to sit (braces shoulders) Sits with support Supine (plays with feet)	Reaches Transfers Mouths	Initiates conversation	Responds to mirror Starts to hold bottle Shows likes and dislikes	
Screening at 9 months	No squint Normal eye movements Near vision Follows dropped toy	Rolls over Weight bears Sits without support Crawls Pulls to stand	Distraction Hearing test Holds cubes in both hands Immediately reaches out	Vocalises delibrately Bebbles Responds to name	Stranger anxiety Holds cup and bottle Plays: 'peek – a boo' with mother	Not sitting Hand preference Fisting Squint Primitive reflexes + No resonse to sound
10 months		Pulls to stand	Picks up	Waves	Plays peek-a-	

		Walks with assistance	small object b/w thumb and index finger	bye – bye Shakes head for no	boo with mother	
12 months		Bear walks Walks holding on	Pincer grip Releases object on request	Knows name Simple words: come, go	Finger feeds Arm into sleave	Unresponsive to sound Abnormal grasp
15 months		Walks alone	2 cubes tower	Jabbers	Holds & drinks from cup Attempts feeding with spoon Spills most	
Tests screening 18 months	Near vision Far vision	Pulls and carries toy Climbs into chair Walks well	3 cube tower Pincer grip Scribbles	3 or more words – excluding mama dada Obeys simple commonds	Indicates toilet needs – wet nappy	Failure to walk No pincer grip Inability to understand simple commonds No spontaneous vocalisation Mouthing Drooling
2 years	Near vision test	Runs Stairs up and down- 2 feet per step Kicks ball	6 cube tower Train with cubes Immitates vertical line Hand preference	Short phrases Uses pronouns	Clean and dry in day Spoon feeds - no spilling	Not understnding Tremor Incordination
3 years		Rides bicycle Stairs: Up 1 foot step Down 2 feet step	9 cubes tower Bridge Copies circle	Sentences Knows name and sex Talks incessantly	Toilet trained Dresses without supervision	Ataxia Using simple words only
4 years		Hops on preferred foot	Builds gate with cubes	Knows full name, age,	Eats with spoon and fork	Poor articulation

		Stairs: up and down 1 foot step	Copies cross	home address Matches colours	Washes and dries hands Make-believe play Dresses and undresses	
Screening 5 years	Near and far vision test Hearing test history	Walks easily along narrow line - heel to toe Hops on either foot Bounces ball	6-10 cube steps Copies square and triangle Draws a man with full features (6 parts)	Knows birthday Fluent speech	Uses knife and fork well competently Chooses own friends Dresses and undresses alone	Emotional immaturity
6 years		Walks backward on straight line (10 paces)	10 cube steps Copies diamond	Word definition Composition	Co-operative play	Clumsy Poor posture
7 years		Adds Substratcs 2 digit numbers Counts 2's, 100's	Draw a man Diamond	Defines words & nouns Similarities & differences	One special friend	Poor pencil grip
8 years		Counts 5's, 100's Simple multiplication	Cursive writing	Knows days of the week Talks sentences of 10 syllables	Dresses, undresses completely withot help	
9 years		Simple division 2 digit multiplication fraction	Cylinder	Understands obsurdity		
10 years		Division Runs downstairs	Writes three word sentences	Complex meaning Produces all speech sounds including 's', 'z' and 'ng'	Takes full responsibility for personal care	Speech sound difficulty

AN APPROACH TO A HANDICAP CHILD

Parents may visit with one or more of the following complaints:

- The child is delayed in sitting or walking i.e. delay in motor development
- The child is slow in all aspects of development (motor and social)
- The child is slow to talk (language delay)
- The child repeatedly falls in the early grades at school
- The combination of all above – global developmental delay

Past history

Take full past history.
Look for incidents that may have caused neurological damage.
Note the following in particular:

Maternal: Age of mother (Down syndrome in older women)
Illness of mother during pregnancy – eclampsia, rubella, drugs, alcohol

Delivery: Abnormal means of delivery – forceps, vacuum etc.
Condition of the baby at birth, was there a prolonged period of cyanosis, or did he/she take long time to cry and breath normally.

Prematurity: The degree can be assessed by the duration of stay in the hospital after birth

Postnatal: Jaundice/kernicterus - any history of exchange transfusion
Fits in newborn period have a close association with later handicap

Past illnesses:

- Ask for history of severe diarrhoea & dehydration. This may have caused a cerebral cortical vein thrombosis or electrolyte abnormalities more specifically hypo or hypernatraemia.
- Has there been a serious illness needing hospital admission such as pneumonia (hypoxic episode) or meningitis either bacterial or TB meningitis?
- Has there been a head injury?

Family history:
Is there a history of developmental delays or hearing loss or other handicapping disorder?
If so, there may be a genetic basis

Developmental history:
Most parents do not remember minor milestones such as rolling over or holding head clear of the bed. It is best to enquire about the major milestones such as smiling, sitting unaided, standing, walking alone and saying single intelligible words. Remember there is never a fixed normal age for reaching a particular milestone. There is always range of normality.

Upper limits of normality – if abnormal refer for assessment

- Not smiling by 8 weeks
- Not sitting unaided by 9 months
- Not standing unsupported by 12 months
- Not walking alone by 18 months
- Only single word with meaning at 36 months

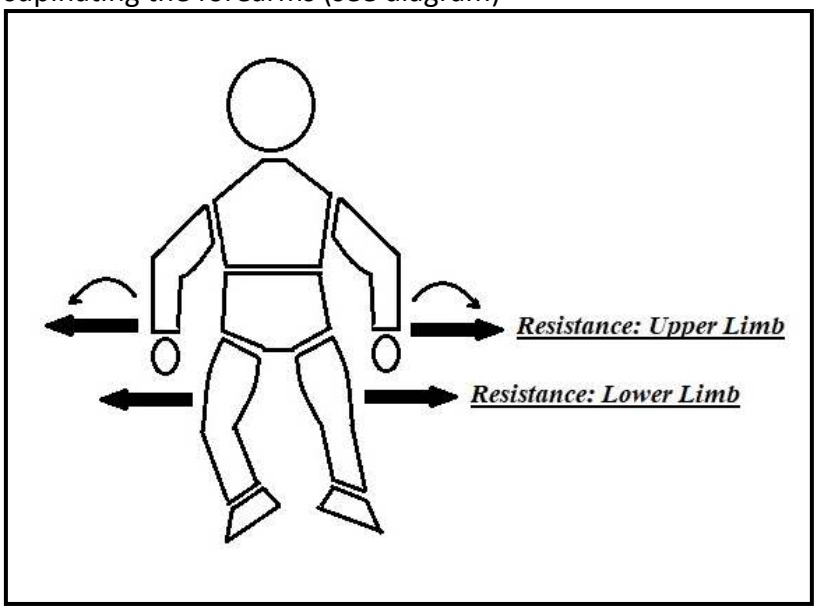
Delay in sitting or walking: the main causes of motor delay are:

1. **Severe illness:** a child recovering from severe acute malnutrition or measles may be static in his motor progress.
2. **Mental retardation:** these children are usually delayed in all aspects of development
3. **Cerebral palsy:** this is a group of motor disorders caused by an insult to the brain at or near the time of birth. Three important types are:
    a. Spastic (increased tone)
    b. Athetoid (abnormal movements)
    c. Hypotonic (decreased tone)
4. **Rare neuromuscular disorders:** cause severe hypotonia like spinal muscular atrophy

EXAMINATION OF MOTOR SYSTEM

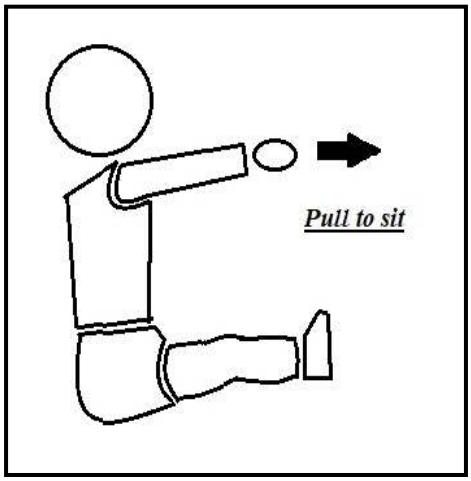
1. When the child is lying on his/her back

a. Observe the child's position
    - In spastic cerebral palsy (CP) the limbs are usually extended
    - In hypotonic states the limbs lie flat on the bed
b. Perform passive abduction with knees flexed and straight to test tone
    In spastic CP there is usually increased tone especially on abducting the knees and supinating the forearms (see diagram)



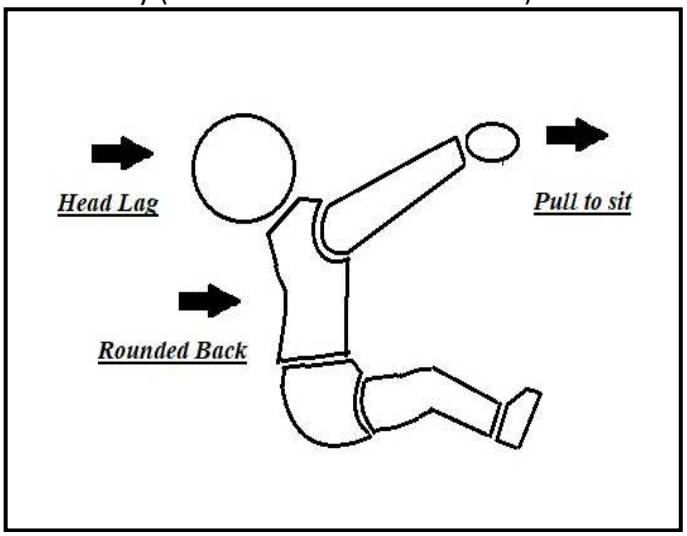
In hypotonic states tone is reduced and the limbs are floppy

2. Pull-to-sit:

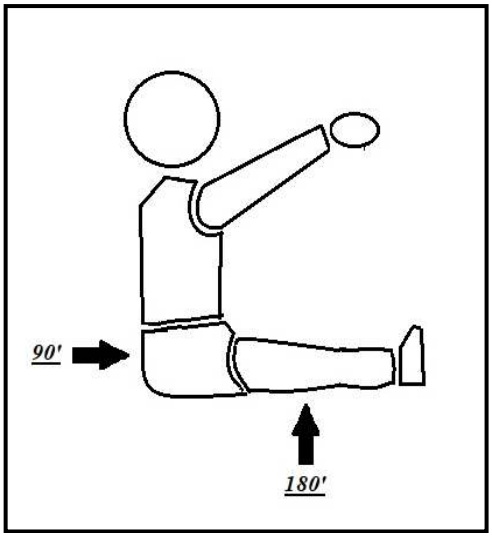


Start with the child lying on his back.
Take his hands and gradually pull up to a sitting position.
Observe (diagram)

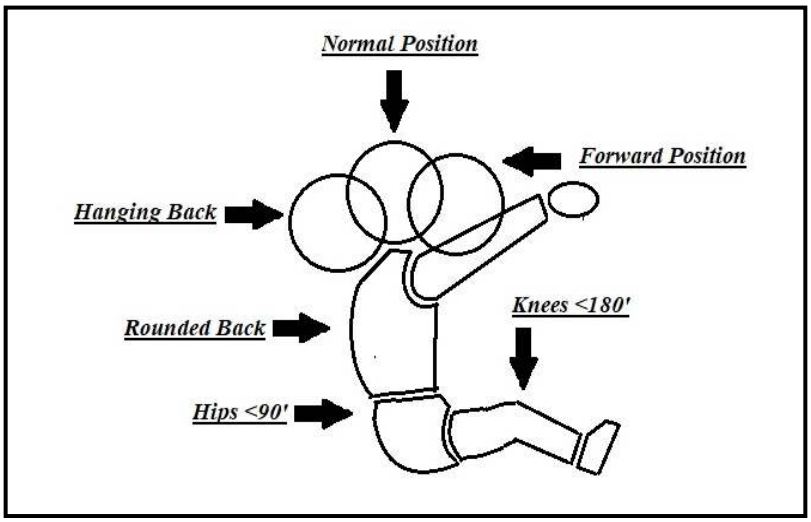
a. **Head:** does it fall back or stay in line with the baby or even come forward ahead of the baby (as is normal after 6 months).



b. **The curve of the back:** is it very rounded like a newborn baby or straight (which is normal after 6 months of age)
In both spastic and hypotonic cerebral palsy, the back is abnormally rounded



c. **Position of the hips and knees:** the normal position after 6 months of age is as seen in the Diagram



In spastic CP the hips are at less than a right angle and the knees remain flexed. Head may be in normal position, forward or hanging back in the young infant

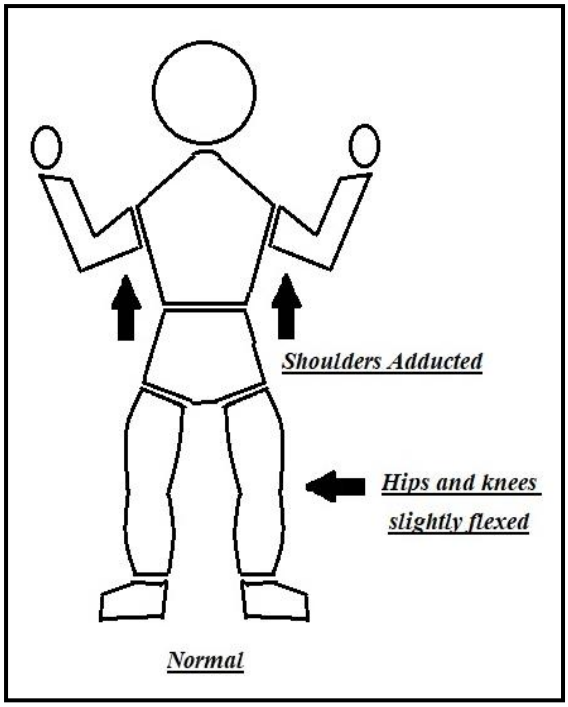
d. Can the child sit unaided? This is normal after 6-9 months of age.

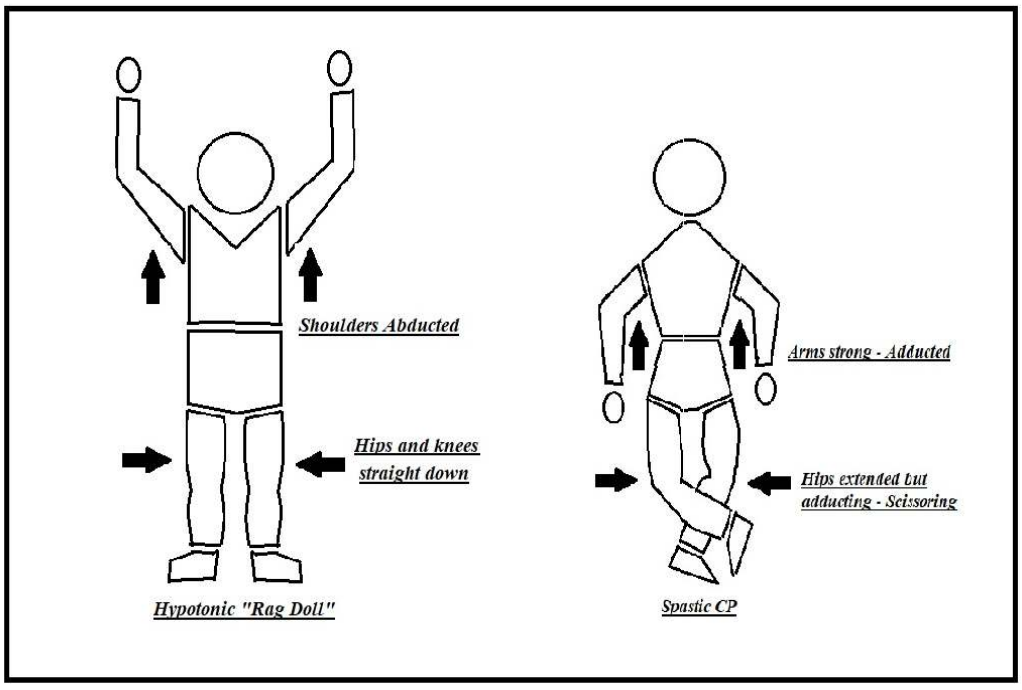
3. Suspension

Hold the child under the armpits and lift him clear of the floor or couch.

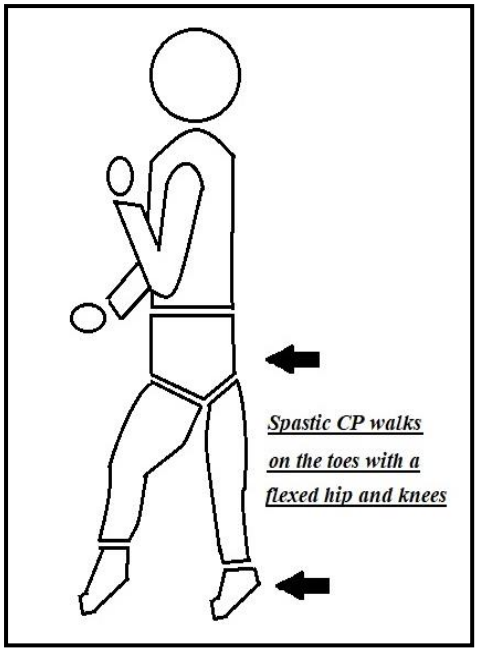
Observe:

a) Does he slip through your hands like a rag doll? This is typical of hypotonic states.
b) The position of the legs: in spastic CP the legs and feet extend abnormally and tend to cross over each other. This is known as scissoring (see diagram).





4. ***Walking:*** if the child can walk get him to walk up and down your consulting room or the corridor and observe:
   a. Movements of arms: do they swing freely as is normal or does one arm not moving. In hemiplegia one arm may be held at the side or comes up and is held in the position without swinging
   b. The legs: in spastic CP the walk is on the toes with a flexed hip and knee (see diagram). Take very small steps and legs are internally rotated.



Management of children with motor disorders

- If your assessment suggests motor disorder, the child should be referred to specialist centre for diagnosis and treatment purpose.
- In the case of CP, it is vital to begin expert physiotherapy as soon as possible.
- Intensive therapy can make a great difference to the child's final degree of handicap.
- The therapist usually sees the mother and child weekly for a prolonged period.
- The mother must be taught the techniques and exercises so that therapy can continue at home.
- In many remote areas it is quite impossible for the pair to come regularly. In these cases, it is useful to admit the child together with mother to hospital for a week or two several times a year.
- During these times the mother is taught the correct positioning and exercises for the child which she then carries out when they return home.
- The therapist can also supply them with simple aids such as positioning wedges and chairs made out of cardboard or other disposable material.
- Children who are unable to walk eventually become too heavy for the mother to carry and need a wheel chair.
- The collapsible very light 'Buggy-Major' or similar model is particularly suitable as it can be folded up for easy storage, fits in the boot of a car or can be taken on a bus.

AN APPROACH TO A CHILD WITH SPEECH DELAY

Take a full history as above and try to establish if there is really a significant speech delay;

Its normal development if the child is:

- 10 months: uses one word with meaning
- 1 year: uses 2-3 words with meaning
- 21 months: joins 2 words, repeat things said, ask for food, drinks
- 2 years: uses I, me, you and talks incessantly
- 3 years: knows name and sex, uses 3 words sentences

There is quite a wide range around these normals but it is always abnormal to be using only single words at 3 years. Always ask for a speech development of siblings and parents as benign delay in speech tends to run in families.

Carry out full physical examination. This may reveal an associated handicap such as CP. If delay is present, consider the possible common causes. Speech is learned by imitation of sounds the child hears. It is not part of normal natural development such as walking.

Deafness or hearing loss: It is essential to assess the hearing of any child with speech delay. Details of simple screening tests are given below. If your screening test suggests hearing loss, the child must be referred for formal audiometry at the ENT department of a hospital with the necessary staff and equipment.

Mental retardation: in this case there will be evidence of major delay in most other aspects of development such as motor and social.

Environmental deprivation: a child who is not frequently exposed to the speech of adults and children will be delayed in speech development.

Isolated delay in speech development: in this disorder other aspects of child's development including hearing are normal. It is an isolated disability, akin to dyslexia.

MANAGEMENT

This depends upon the cause. With deafness or hearing loss, it is important to place the child in therapy as soon as the deafness has been detected. If this is delayed the child may subsequently have greater difficulty in learning to speak.

Babies attend group parent sessions with the speech therapists who teach how the baby can be stimulated. From 3 years the child may attend a special nursery school and later a special school for the deaf. These schools are equipped with special apparatus and the staffs are specially trained in teaching the deaf. The child with isolated speech delay needs intensive speech therapy. The mentally retarded deaf child is largely managed as discussed in the section of mental retardation.

Screening tests for hearing loss: (see in ENT examination section)

- 0-6 months: Observe if the young infant quietens to the sound of his mother's voice or if he turns his eyes towards a sound.
- 6-12 months

The rattle test: it is essential to use the proper acoustic rattle which is obtainable from the ENT department, Tygerberg Hospital, Parow, Cape Town.

Method: the child sits on the mother's lap facing forward. The room must be quiet. The examiner stands behind the mother out of sight of the child. The rattle is held about 5 cm from the ear. Then turn the rattle through 90 degrees. This will produce a soft high frequency sound. If the child can hear it, he will usually turn his head to look at the source of the sound. The other ear is then tested. If the result is doubtful refer the child for normal audiometry at the ENT Department of a suitably equipped hospital.

Older children: the easiest screening method is to get the child to repeat the words that have been spoken (not whispered) into the ear at close range (10 cm). The STYCAR (Screening Test for Young Children and Retardates) screening tests are very useful when screening is done on a large scale. These require some simple special equipment. Further advice and help about deaf or hard to hearing children can be obtained from the local branch of The National Council for the Deaf.

The child who is slow in all aspects of Development (mental retardation)

This situation usually involves mental retardation either alone or in combination with other forms of handicap. Causes may include Down's syndrome, perinatal hypoxia, hypoglycaemia or kernicterus

CAUSES OF SPEECH DELAY

1. Bilingualism
2. Hearing loss
3. Mental retardation
4. Expressive language disorder
5. Psychosocial deprivation
6. Autism or elective autism
7. Receptive aphasia
8. Cerebral palsy

CAUSES OF DEAFNESS

Sensorineural hearing loss

1. Waardenburg syndrome
2. Klipple Feil syndrome
3. Alport's syndrome

Conductive hearing loss

1. Achondroplasia
2. Treacher-Collin syndrome
3. Craniosynostosis

NB! Deafness has aslo been associated with severe hypothyroidism and diabetes mellitus