

Class Room

Development of Infant and Young Child : Comprehensive Evaluation

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Introduction

Advances in obstetric and neonatal care in the recent years has led to increased survival of babies viz preterm, low birth weight, congenital anomalies, metabolic problems, who are prone for developing long-term morbidities such as developmental delay, learning disability and visual/hearing problems. The shrinking size of families with a single child has resulted in increased concern and expectancy of their only child by their parents. The rates of infertility are also on the rise, due to working mothers, late marriages, sedentary life style, metabolic syndromes etc., go for assisted reproductive techniques or for adoption. Development of the child is again a concern.

Increased awareness among general population and greater anxiety in parents has forced us as health professionals to be very careful in labelling a child with delay in development or passing off a baby as normal.

In India, prevalence of developmental delay as extracted from various sources shows, that in children under 2 years of age it is about 1.5-2.5%^{1,2}.

Tools that can accurately evaluate developmental parameters must be used by caregivers during baby immunisation visits.

Certain babies who fall in the high risk group need to be followed up at regular intervals in the development clinic.

As we sow, so shall we reap! The first three years are emphasized as the foundational years in every child's life. Specific skills need to be stimulated during the respective 'windows of opportunity', to ensure positive development; for example, red squirrels if not given nuts to crack at certain age, never acquire the skill of cracking them, similarly if chimpanzees are not given bananas to peel within certain age they will never learn to peel. This is the period where the brain absorbs information at its best, like a 'super sponge' and hence, development gallops³.

Only when there is early detection of any developmental delay, the key 'early intervention' can be utilised at its best to help the child to develop his/her potential.

Terminology⁴

Development : It is described as a dynamic process that optimally utilizes the genetic potential of the baby, within the context of the available environment, enabling its achievement of full potential.

Developmental Delay : when a child shows a significant delay in the acquisition of certain milestones or skills, in one or more domains of development (i.e., gross motor, fine motor, speech/ language, social/ adaptive), A significant delay in development has been defined as discrepancy of atleast 25 percent or more as compared to the expected rate, or if a discrepancy of 1.5 to 2 standard deviations from the norm is noted.

Global Developmental Delay : A delay in two or more of the developmental domains, (i.e., gross motor, fine motor, speech/ language, social/ adaptive).

Deviance : If a child develops milestones or skills that are not following the typical acquisition sequence as in case of spastic cerebral palsy, in which the infant rolls over early as a result of increased extensor tone.

Developmental Dissociations : Rates of development differ in different developmental domains like in autistic children often exhibit normal gross motor development but have significant delay in language development.

Regression : When a child loses skills or milestones that are previously acquired it is regression as seen in serious neurological and inherited metabolic disorders.

Advanced motor development gives no indication of intellectual superiority. Sometimes one finds similar history in families. Social and cultural factors play a role. Early exposure and contact with objects allows faster acquisition.

Lateness may be due to familial, environmental factors, temperament, intellectual disability, abnormal muscle tone.

Key Developmental Milestones^{5,6}

Developmental milestones are a set of functional skills or age-specific tasks that most children can perform at a certain age range.

When looking at the development of a child, four domains are considered, Gross motor, finemotor, language, social and adaptive. Each domain and a brief description of the typical developmental sequences for each are given below.

Fine motor	Age in months
Reaching for objects both hands	4
Reaching for objects with one hand, transfer objects	6
Immature pincer grasp	9
Mature pincer grasp	12
Imitates scribbling, tower of 2 cubes	15
Scribbles, tower of 3 cubes	18
Vertical stroke, tower of 6 cubes	24

Table 2 - Fine motor milestones

Gross motor	Age in months
Neck holding	3
Rolls over	5
Sits in tripod fashion	6
Sitting without support	8
Stands holding on	9
Creeps ,stands without support	12
Walks alone	15
Runs	18
Walks up and downstairs	2 yrs

Table 1 - Gross motor milestones

Language development depends on genetic, auditory, environmental factors, intellectual ability, interaction. Most common development delay is delay in language.

Development of manipulative skills not only depend on intelligence but also child's aptitudes.

Language	Age in months
Alerts to sound	1
Coos	3
Laugh loud	4
Monosyllables [ba, da, pa,]	6
Bisyllables [mama, baba, dada]	9
1-2 words	12
8-10 words	18
2-3 word sentences, pronouns, I, Me, you	24

Table 3 - Language milestones

Smile may be delayed in a blind child, autistic child, and in myotonic dystrophy.

Intellectual ability, manipulative ability and opportunity given to learn play a role in acquiring social skills.

Social and adaptive	Age in months
Social smile	2
Recognises mother	3
Stranger anxiety	6
Waves "bye,bye"	9
Comes when called, plays a simple ball game	12
Jargon	15
Copies parents in task	18
Ask for food ,drink, toilet	24

Table 4 - Social / Adaptive milestones

Hearing	Age in months
Respond by startle, blink, cry, quietening,	1
Turn head to sound	3
Turn head to one side and below the level of ears	6
Turn head to one side and above the level of ears	7
Directly looks at the source of sound diagonally	10

Table 5 - Development of hearing

Listening to music commences in utero, as the fetus is immersed in vibrations from the mother's heart beat, breathing, voice and other internal sounds. At five months, the fetus responds with movement to phonemes that it hears through the amniotic fluid, spoken by the mother and by six months, it responds to music by blinking its eyes.

Vision	Age in months
Fixate on baby's mother as she talks to the baby.	1
Fixate intently on an object shown to the baby.	3
Binocular vision	4
Follows objects of interest	6
Follows rapidly moving objects	12

Table 6 - Development of vision

Dressing :
Dresses and undresses by 3-4 years
Tie shoe laces by 4 to 5 years

Feeding :
Baby learns to chew by 6-7 months ,
Finger foods are picked by 10 months
Handle cup by 15 months
Self feeding 2-3 years

Handedness usually established by 2 years
Left handedness is usually seen in twins,
epileptics, psychotics and GENIUS

Visual development depends on Intellectual
ability. Blind child will be born with no facial
expression

Sphincter Control

In the new born period, micturition is a reflex act, and can be conditioned from 1 month. Voluntary control begins by age 15-18 months when baby will say he/she has wet his pants, and may say no if asked whether he/she wants to pass urine. By the age of 2-2½ years he can pull his pants down and climb on lavatory seat unaided. Most of them are dry by day at 18 mon and 90% dry by night at 5 years.

Psychological stress including over enthusiastic training during sensitive period of learning will delay control

At Risk Group

Advancement in perinatal and neonatal care has led to increased survival of infants who form a cohort who are at-risk for developing long-term morbidities such as developmental delay, learning disability and visual/hearing problems. A very effective and rigorous follow-up programme for all the neonates who are discharged from a particular health facility would be practically very difficult and not feasible also. Therefore, it is very important to categorise a cohort of neonates who are prone or are at higher risk of developing these adverse outcomes as 'at-risk' infants⁷. A well co-ordinated and appropriate follow-up program would really help in early detection of these problems thus paving way for early intervention.

Tools And Techniques To Assess Developmental Delay³: Developmental delay can be identified early by a simple process of using screening tools which can be administered with minimum time and equipments.

Parents can also make use of some of these tools to monitor their child's development, while some need a minimal amount of training as used by health professionals. A detailed assessment of developmental milestones should be done in accordance with the corrected age to compensate for prematurity till 24 months of age.

Screening tools: A simple developmental screening test is utilised for quick evaluation of developmental skills and is only meant for identification of children who might have a problem. If the results of a screening test is suggestive of developmental delay in the child, the child should be then referred for a detailed developmental assessment by trained personnel.

- Development observation card [DOC]
- Trivandrum development screening chart [TDSC]
- Language Evaluation scale Trivandrum [LEST]
- Denver development screening test . [DDST]

Developmental Observation Card is a self-explanatory, simple card that can be used by the parents. (Table 7).

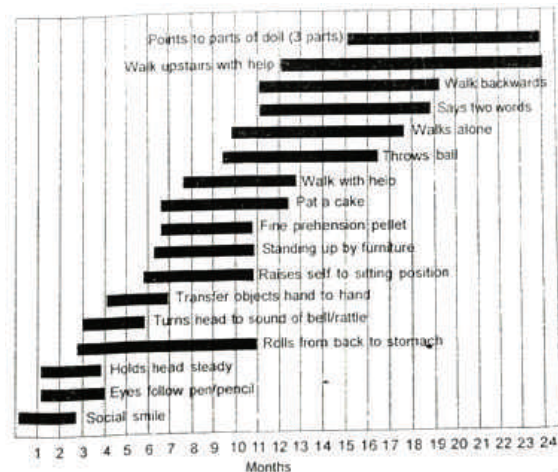
Developmental milestones	Attained age
Social smile	2 months
Holds head steady	4 months
Sits alone	8 months
Stands alone	12 months

Table 7 - Developmental observation card [8]

Trivandrum Developmental Screening Chart (TDSC), is a simple developmental screening test that has been designed and validated at the Child Development Centre, Trivandrum⁸.

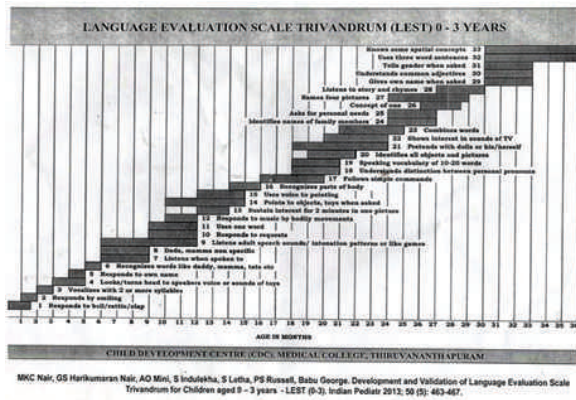
It is used for age range 0 - 2 years and it takes 5 to 7 minutes to apply the test. There are about 17 test items displayed in the chart. The age range for each test item in the scale has been taken from the norms as given in the Bayley Scales of Infant Development (BSID). In the scale there are horizontal dark lines where the left hand side of each horizontal dark line represents age at which 3% of children have passed the item and the right end represents the age at which 97% of the children have passed the item. There are 24 vertical lines marked in the chart which represents age in months.

The test can be administered as follows where a vertical line is drawn or a pencil can also be kept vertically, at the level of the chronological age of the child who is being tested. If the child fails to achieve any item i.e developmental milestones that falls short on the left side of the vertical line as noted above, the child is considered to have a developmental delay.



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Language evaluation scale Trivandrum (LEST) : LEST is a scale designed to detect language delays between 0 and 3 years and contains age appropriate developmental milestones pertaining to expressive language and receptive language. If the child fails a single item in the age group he is considered to be at risk for developing speech and language delay⁹.



Denver Developmental Screening Test-II (DDST-II): This tool is used for children of age group ranging from 2 weeks to 6 years. The test comprises of 125 items, that are divided into four categories: • Gross Motor • Fine Motor/Adaptive • Personal Social • Language. These items are arranged in chronological order according to the age at which most of the children pass them. The administration of test takes 10 - 20 minutes by a trained personnel and procedure consists of asking the parent questions regarding the child's development and making the child perform various tasks using a Denver kit and observing the same³.

Developmental Assessment Tools³: Developmental evaluation is an elaborate, in-depth assessment of a child's skills and is usually can be administered only by a highly trained professional, such as a developmental therapist who uses various assessment test to create a profile which gives us a view of child's strengths and weaknesses in all the developmental areas. These results as obtained after a developmental evaluation are then used to plan the treatment and also to determine if the child needs early intervention services or rehabilitation services.

Tools : Developmental Assessment Scale for Indian Infants (DASII), Bailey scales of infant development Third edition [BSID III].

Approach^{4,10}

Screening Test (Doc/Tdsc/Ddst)

Detailed history

- Past medical history such as any, biological causes like prematurity, kernicterus genetic as in, Down syndrome, environmental hazard like exposure to lead and psychosocial factors viz., maternal education, family income, marital status etc.
- Protective factors such as supportive family, opportunities given to interact with other children in a safe environment should be ascertained.
- Detailed Developmental history that helps us in evaluating gross motor, fine motor, expressive and receptive language, as well as social skills.
- Family history of any developmental delays, learning disabilities, hyperactivity, and any other behavioural and psychiatric problems has to be asked for.

Detailed examination

- Growth assessment by evaluating Height, Weight, with due attention paid to head circumference, we have to look for macrocephaly, microcephaly, or if there is any increased growth velocity.
- Detailed Dysmorphic examination that includes minor and major anomalies that might give a clue for the etiology of the developmental delay should be noted.
- Neurologic examination that includes assessing the strength of muscle, tone by measuring the angles [Amiel Tison angles], symmetry and also the presence or absence of primitive reflexes to be noted.
- Developmental assessment to be done using either of the available scales : DASII or BSID III
- Hearing assessment to be done with: OAE, BERA
- Assessment of vision includes : ROP screening, Visual acuity, colour vision and Fundus Examination.

Investigations

- Cytogenetic studies like karyotyping and DNA testing to rule out Fragile X syndrome, and microarray-based chromosome analysis for arriving at the diagnosis.
- Neuroimaging with an MRI is indicated.
- An EEG should be obtained in cases that are associated with epilepsy.
- Metabolic screening is usually indicated for those who present with pertinent history or physical findings and also those who have not undergone universal newborn screening.

References

- 1) Nair M, Radhakrishnan S. Early childhood development in deprived urban settlements. Indian Pediatr 2004; 41: 227-237.
- 2) Nair M, George B, Padmamohan J, Sunitha R, Resmi V, Prasanna G, et al. Developmental delay and disability among under-5 children in a rural ICDS Block. Indian Pediatr 2009; 46: S75-S78.
- 3) Nair MKC, Deepa Bhaskaran, Babu George. Developmental assessment .When and How? Developmental Pediatrics. Indian journal of practical pediatrics, 2012; 14(4): 401-407.
- 4) Jennifer K Poon, Angelac Larosa, G Shashidharpa; Developmental delay: timely identification and assessment. Indian Pediatr, 2010; 47: 415-422.
- 5) Vinod K Paul, Aravind Bagga, Aditishin. Ghai Essential Pediatrics, Eighth edition, CBS, 2013; 49-53
- 6) MKC Nair, Paul Russel. Illingworth's - The Development of the young child, Normal and Abnormal, 10th edition, Elsevier-2013; 157-167

- 7) Pradeep Kumar, M.Jeeva Sankar, Savita Sapra, Ramesh Agarwal, Ashok Deorari, Vinod Pau. Follow-up of High Risk Neonates AIIMS- NICU protocols 2008. Downloaded from www.newbornwhocc.org
- 8) Nair MKC, George B, Philips E, Lakshmi M A, Haran J C, Sathy N: Trivandrum Developing Screening Chart. *Indian Pediatr*, 1991;28(8): 869-872.
- 9) Nair MKC, Harikumar Nair GS, Mini A, Indulekha S, Letha S, Russell PS et al. Development and validation of language evaluation scale Trivandrum for children aged 0-3 years - lest (0-3). *Indian Pediatr*. 2013;50:463-467.
- 10) Battaglia A, Carey JC. Diagnostic evaluation of developmental delay/mental retardation: An overview. *Am J Med Genet* 2003; 117C: 3-14.

Empathy and PTSD

Post-traumatic Stress Disorder (PTSD) is precipitated in 7 to 8 percent of people when they experience a shocking or dangerous event. Such individuals may suffer from flashbacks, negative thoughts and from a tendency to avoid places, events and objects. Sometimes, PTSD may not manifest immediately after the event but may develop much later. The problem with PTSD is that it is not limited to those who experience a painful event; recent evidence suggests that even people such as relatives, loved ones or caregivers, who on their own have not gone through the traumatic experience but merely have interacted with such individuals, may become afflicted by PTSD. Studies on mice have revealed that observing fear or distress in others or even hearing about it may bring about changes in the brain leading to increased flow of information in the deeper layers of cerebral cortex. Empathy may not simply be an ability to comprehend and share the feelings of another person but a phenomenon associated with changes in brain connectivity.

(Lei Liu et al., *Neuropsychopharmacology*, doi: 10.1038/npp.2016.273, published online 7 December 2016)

- Dr. K. Ramesh Rao