# The Neuro-Sensory Motor Developmental Assessment Part 1: Development and Administration of the Test

*The Neuro-Sensory Motor Developmental Assessment (NSMDA) has been developed to meet the need for a progressive developmental assessment of infants and children. In this study a cohort of 148 preterm infants was assessed at 1, 4, 8, 12, and 24 months adjusted age. The results were used to classify the subjects as having normal, suspect or abnormal developmental status. The scores for each time were correlated with outcome scores at 24 months.*

*Part One of this paper includes a description of the development and administration of the NSMDA. Longitudinal and cross correlations of scores were analysed and shown to be highly significant over the first two years of testing, thereby establishing the basis for validity and predictability of the NSMDA.*

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Assessment of posture, movement and motor function in developing infants and children forms an essential component of the skills of the physiotherapist working in paediatrics. There is a particular need for an assessment suitable for infants and children who were very short gestation or very low weight at birth.

There are important ways in which assessment improves knowledge of, and service to, children. These include evaluating progress over a period of time, comparing performance of a child with that of a similar group of peers under similar conditions or against a number of set criteria, planning treatment directions, or determining the benefit of some type of intervention.

Assessment of development and movement in very young children brings with it a number of particular challenges. These relate to the number of on-going changes associated with growth, neural maturation, inherited characteristics, personality and the constant transactions occurring between the child and the environment (Ausubel and Sullivan 1970, Sameroff 1980).

Despite an extensive range of valid and reliable assessments suitable for evaluating the general developmental progress of infants and young children or for identifying problems or delay (King-Thomas and Hacker 1987), there are very few which meet the needs of the physiotherapist.

Assessment means to 'rate' or put a value on an achievement or response to a specific test. In the evaluation of motor development it is inappropriate to rate a performance on a pass/fail basis. An essential factor to be determined is *how* the infant or child performs the movement. However, qualitative judgements can become very subjective unless stringent test criteria are established and adhered to in the administration of each test.

*A criterion-referenced test* describes an expected level of performance and consists of items which reflect the components needed to complete a task, respond to a stimulus or perform a skill (Rogers 1987). Therefore the child's performance is measured against a set standard on a number of items rather than compared to the performance scores of a large peer group as in a *norm-referenced test*. A criterion-referenced test gives an indication of a child's level of performance whereas a norm-referenced test gives a child's position relative to a peer group.

The physiotherapy neuro-sensory motor developmental assessment (NSMDA) is a criterion reference assessment developed through many years of experience working with normal, delayed and disabled infants and children.

The assessment is presented in two sections. Part One will describe the development and administration of the test and the consistency of the scores at each age, while Part Two will provide statistical evidence of its validity.

## Development and Administration

### Designing the Assessment

When designing a criterion-referenced assessment a sequence of decisions has to be followed to determine which test items should be included and the particular criteria to be met. The sequence followed in establishing the NSMDA included:—

1. Defining the purpose of the assessment. This was to evaluate and document the neuro-sensory motor developmental integrity and progress of 'high risk' and very low birthweight infants. The NSMDA was designed to complement psychological and medical paediatric assessments.

2. Establishing a detailed knowledge and understanding of assessable functions appropriate to the task and to the age of the infants and children at the time of testing. This was drawn from an extensive review of the relevant literature and previous studies (Burns and Watter 1974, Burns and Harrison 1978, Burns and Bullock 1985, Burns *et al* 1984, 1987). This also included reviewing the reliability of various age appropriate test items.

3. Selecting from a very large pool of test items, a balanced, representative number of items which would provide the desired information in all areas of motor development, without causing fatigue, stress or negativity in the child. In selecting items it was also extremely important to keep in mind the purpose of the assessment, the tests included in the psychological evaluation (Griffiths 1970) and the paediatric medical examination, as well as the need to maintain a consistency across all ages with regard to aspects being assessed. One of the main reasons for failure to predict outcome previously has been the variability of tests over the age range (Fitzgerald *et al* 1977).

4. Determining the criteria and method of scoring for each item included in each area of the assessment.

**Establishing the Criteria**

The areas of motor development to be evaluated were identified as gross motor and fine motor performance, neurological and musculo-skeletal status, reactions which control the development of posture and balance and the motor response to relevant sensory input. (As musculo-skeletal aspects in this study were included in the medical examination, they were excluded from the physiotherapy record. Normally this aspect is included.)

The items selected in each of the above areas are shown in Appendix 1. Only those items essential to meet the aims of the assessment and the study were included. It is important to realize that many of the children had a low endurance due to their extreme prematurity or various neonatal problems. The constraints of distance, time and expense meant that all assessments (including sometimes vision, hearing, pathology and other tests) had to be carried out on the one day.

The details of each test with regard to testing or starting position, stimulus or technique to be used, task or activity to be observed and expected outcome or response for age conformed to already well established criteria (Burns and Harrison 1978, Burns *et al* 1984). At each age the main changes in test items occurred in the areas of gross and fine motor milestones and activities.

Other age related differences were in the type of expected response, for example, primitive patterns of movement and postural righting. In the areas of gross and fine motor performance some items tested quantitative aspects of the activity while others evaluated it qualitatively in order to give a balanced perspective.

For test items to be considered for inclusion in any evaluation instrument inter-observer reliability has to be demonstrated to be highly consistent. The inter-observer reliability was determined by percentage of decision consistency, *ie* the percentage of children whose test scores resulted in the same categorisation on repeated measurement by different physiotherapist observers or testers.

Each test item in the assessment was given a numerical score to indicate its level of response. The scores ranged from definitely abnormal, through immature, delayed or suspect response, to within normal range for age, to better than expected for age.

This scoring system is in contrast to many neurologically based tests which score from least to most. Such tests present a difficulty with items like tone and basic reactions because abnormal scores are represented by either low or high values.

Right and Left were scored separately for many items, so that the scores would reflect any asymmetries present. In addition to scoring each item the physiotherapist graded the child's performance in terms of function at the end of the assessment.

These grades indicated the overall impression gained by the physiotherapist throughout the testing in each area of the assessment. Each area was given a functional numerical grade to indicate normal function, minor deviations, moderate problems, to severe and profound disability (*ie.* absent or virtually absent function).

**Assessment Procedure**

The age of the child and hence the expectations for age was always adjusted for the number of weeks born early. The behavioural state of the infant or child at the time of testing is extremely important. Factors such as health, fatigue and time in respect to meal and sleep times could adversely affect the level of response and were taken into account. The method of administration of the assessment allowed the assessor flexibility so that the child's interest could be motivated through age appropriate interaction. The behavioural state during each assessment was recorded.

Often concurrent physiotherapy and psychology assessments determined the actual sequencing of the testing but did not alter the test criteria. Items which involved positions, handling or stimuli which were likely to cause apprehension, negativity, over excitement or changes in basic reactions or tone were left until last.

The parents were always within the child's interactive environment to diminish anxiety in the child. A state of quiet but active participation was encouraged and maintained throughout. The child's most comfortable position was selected as the starting position. Generally this was supine at 1 month, supported sitting, supine or even prone at 4 months, sitting at 8 months, standing or sitting at 12 and 24 months.

**Equipment and Environment**

A calm, warm, quiet but not silent environment with a padded mat area and a few age appropriate toys provided the suitable testing environment for children under two years of age. Time to adjust to the environment with easy access to parent or caregiver was seen as essential.

The children were always undressed either before or during the early stages of the assessment to ensure accurate observation of posture and movement at all times. Thus, in addition to testing specific responses and reactions, the tester was able to note subtle postural adjustments and the sequencing of muscle action which are important elements in the evaluation of quality of movement.

The assessment required very little equipment as most testing techniques involved observation of selected tasks or activities (rolling, sitting, standing, walking), holding the child in specific positions (righting reactions), or providing specific tactile or proprioceptive input (reflex patterns, tone, clonus).

Necessary equipment included a very small 2 cm brightly coloured ball suspended from a coloured plastic ring (eye follow and reach and grasp); a bell and a quiet rattle (auditory motor response); small wooden blocks, car and ball, and a plastic cup (passing from hand to hand and manipulating in the hand); a string of tiny beads (for opposition and fine pincer); a toy with a hole in it to induce finger pointing, and a puppet for eye follow in the older infant and child. At two years additional equipment included a ball for kicking and throwing, a book for turning pages, a marker for pencil hold, small blocks or pegs for co-ordination and beads with stiff thread, a screw toy for forearm rotation and a simple puzzle.

**Administration of Test Items**

Testing began in a suitable position as already described, with items which gained the child's attention and interest. Gross and fine motor aspects were assessed during suitable age appropriate activities.

Tone was assessed with the child fully supported in supine or if necessary in sitting position. Then using a palmar hold to avoid facilitating resistance, the muscles were taken at varying speeds through the range for all movements of each joint in upper and lower limbs. When there was a feeling of low tone the degree of passitivity or flappability was tested to indicate the level of hypotonicity.

Deep tendon reflexes in knee extensors, elbow flexors and hip adductors (crossed response) were tested to determine the reaction to quick stretch. The number of beats of ankle clonus were recorded as none, < or >8 at 1 and 4 months, and, < or >6 beats thereafter. Tremor was recorded at rest, during quiet activity, and when upset. Consistency, frequency of tremor and the body parts involved were also recorded.

Primitive patterns of movement elicited as reflexes were tested according to the criteria of Prechtl (1977) with the exception of the tonic labyrinthine reflex (TLR). To evaluate the real influence of this primitive pattern, the child was supported around the thorax in upright sitting and then gently lowered backward towards supine.

If the TLR is present, at about 45 degrees, the head will extend, the shoulders will retract and even the hips and spine may extend. Infants with weak neck flexors will lose head control only and those who extend out of habit in supine will not extend in this method of testing until the last few degrees.

When the flexor component of the TLR is present in prone it is frequently evident as a positive flexion of the trunk when the infant is moved slowly from sitting forward to about 45 degrees.

A number of very prematurely born infants tend to 'arch' during the first 6 months and it is extremely important that the reason for the arching is correctly evaluated.

Head righting was tested in both vertical and horizontal positions from 4 months. The Landau reaction was recorded as a separate item. The parachute method of testing the protective movement of the arms forward, to each side and to the back was used at the same time as testing downward parachute of the legs.

In this test other body righting weight shift and supporting reactions formed part of the qualitative testing of gross motor but usually are recorded separately as postural control. Testing of equilibrium in sitting and standing was included in the 12 and 24 month assessments.

Postural and or motor response to light touch, joint positions, eye follow, and vestibular input were tested and recorded as separate items.

## Method

The cohort consisted of a total of 148 preterm infants who regularly attended the Growth and Development Clinic at the Mater Misericordiae Children's Hospital for follow up.

The major criterion for inclusion in the study was a birth weight of less than 1500 grams *i.e.* very low birth weight (VLBW). The birth weights ranged from 660 to 1499 grams, and the gestational ages from 25 to 38 weeks. All children were born between 9th May 1983 and 22nd September 1985. The mean values, by sex are presented in Table 1.

The infants were assessed by a multidisciplinary team at one, four, eight, twelve, and twenty four months adjusted age. At each visit neurological, sensory and motor development was assessed in detail by a physiotherapist. The assessments were divided up into a total of six areas: Gross Motor, Fine Motor, Neurological, Primitive Reflexes, Postural Reactions and Sensori-Motor Response.

The children were also assessed medically by a paediatrician and developmentally by a psychologist. The physiotherapy assessment procedure involved two types of evaluation. Firstly each test was item scored, and secondly, performance in each area was evaluated by the physiotherapist giving a functional grade (see Appendix 1 for a list of individual test items).

The item scoring ranged from 1 to 4 where applicable. The scores were: 1 — definitely abnormal, 2 — suspect, delayed or mildly abnormal, 3 — normal, and 4 — above average (where appropriate).

The functional grades ranged from 1 to 5 with 1 — normal, 2 — slight deviation with no effect on function, 3 — mild to moderate deviation with some effect on function, 4 — definite deviation limiting function and 5 — severe/profound disabilities with virtually no function.

The total number of infants assessed at each time is shown in Table 2. Sometimes testing of individual items was not possible due to severity of disability, illness and other restrictions on testing, and for this reason, a few children could only be given a functional grade.

As the behavioural state can obviously affect the performance of a

**Table 1:**
**The mean values of subjects sex, weight and age at birth**

| | *Males* *Mean* | *Females* *Mean* | *Total* *Mean* |
|---|---|---|---|
| Birth weight (g) | 1151.1 (±209.8) | 1153.8 (±211.6) | 1152.7 (±210.1) |
| Gestational age (wks) | 28.9 (±2.6) | 29.1 (±2.3) | 29.0 (±2.4) |
| Number | 63 | 85 | 148 |

**Table 2:**
**Total number of infants tested at each assessment**

| *Adjusted Age (in months)* | *Item Scoring* | *Functional Grade* |
|---|---|---|
| 1 | 134 | 139 |
| 4 | 125 | 130 |
| 8 | 123 | 126 |
| 12 | 126 | 134 |
| 24 | 129 | 133 |

child in both quality and intensity of responses, this was observed at each assessment. The ideal behavioural state for each assessment is either quiet or active awake. In each assessment, the number of children who fell into this category was not less than 85 per cent, and the average of all assessments was 87.9 per cent. It can be seen from these figures that a high percentage of children were assessed while in an ideal behavioural state, and that unsettled or lethargic behavioural states did not bias the outcome for either individual children or the group.

To investigate the consistency of scores across a period of time it was necessary to develop a method of data management, so the item scores for a given assessment area were summed and adjusted to percentages. As the number of items making up the composition of each area varied with the assessment and the age of testing, the six areas (except at one month when there were five) were added together and averaged to yield a composite NSMDA item score.

Since correlations between functional grade and item scoring were to be calculated, it became necessary to adjust the functional grade scores so that they exhibited a similar pattern to the item scoring. The adjustment was necessary so that correlations would be positive, thereby avoiding potential confusion. The equation used was: TFG=(5n-Sum of x)/5n × 125, where TFG=transformed functional grade, n=number of assessment areas, x=functional grade (this equation converted to the scores to the same type as the item scoring, for example a normal child would score 1 for each of 6 areas, therefore the TFG would be (6 × 5-6)/(6 × 5) × 125=100, whereas a completely abnormal child would score 5 for each of 6 areas, yielding a TFG of (6 × 5-30)/(6 × 5) × 125=0). Once the data had been collected, they were analysed using the SAS package on a Cleveland XT and a Uni-X AT personal computer.

## Results

To investigate the consistency of results at each assessment, a cross correlation matrix was prepared for both item scores and functional grades. The results are presented in Table 3.

All observers were trained in the scoring procedure, and inter-rater reliability was tested on several occasions during this and previous studies. The procedure involved one person assessing the child, and this person and two observers simultaneously recorded scores for that child. This repeatedly produced correlations of 0.8 or above. At each assessment, the testers were blind both to the perinatal history and the previous test results.

The predictive quality of the NSMDA was established by designating 24 months as the final outcome, and finding the longitudinal correlations between it and each assessment as shown in Table 4.

As can be seen, the correlations converge on final outcome in a linear fashion, reflecting an increase in predictive precision.

Both item score and functional grade total scores were significantly correlated with final outcome (twenty-four months) at each assessment, showing the NSMDA to be reliable over time. The consistency of scores highlights its predictive quality. A further set of longitudinal correlations was calculated for each of the assessment areas and these data are presented in Table 5.

Most of the assessment areas show the same pattern as the total scores. It is important to note that at one month there are very few postural reactions to be tested and it is not surprising that this aspect has not contributed much to the score at this age. If each of the six areas of assessment are examined in turn it is apparent that at one month some individual areas are not significant relative to the final outcome, and yet when combined, the result is significant.

This highlights the fact that all areas of assessment need to be combined to take into account the complexity and effect of interaction of these areas on motor development. This is also the case for four and eight months, nevertheless it is notable that the assessment has increasing power with age, in all of the individual items. In other words, although individual areas of the assessments are helpful (*eg* for treatment planning), it is necessary to look

**Table 3:**
**Cross correlation matrix: Consistency of results at each assessment NSMDA scores**

| *A Item scoring* | *4 Months* | *8 Months* | *12 Months* | *24 Months* |
|---|---|---|---|---|
| 1 Month | 0.20277 $p<0.05$ | 0.25916 $p<0.01$ | 0.26485 $p<0.01$ | 0.25028 $p<0.01$ |
| 4 Months | | 0.51587 $p<0.001$ | 0.50144 $p<0.001$ | 0.46371 $p<0.001$ |
| 8 Months | | | 0.64602 $p<0.001$ | 0.60962 $p<0.001$ |
| 12 Months | | | | 0.72981 $p<0.001$ |
| *B Functional grade* | *4 Months* | *8 Months* | *12 Months* | *24 Months* |
| 1 Month | 0.32391 $p<0.001$ | 0.23056 $p<0.05$ | 0.40276 $p<0.001$ | 0.36007 $p<0.001$ |
| 4 Months | | 0.48875 $p<0.001$ | 0.57396 $p<0.001$ | 0.56533 $p<0.001$ |
| 8 Months | | | 0.68609 $p<0.001$ | 0.63953 $p<0.001$ |
| 12 Months | | | | 0.87318 $p<0.001$ |

**Table 4:**
**Longitudinal correlations: Correlation of NSMDA scores at each assessment with scores at 2 years**

| | *NSMDA Total Scores* | | | |
|---|---|---|---|---|
| *Adjusted Age (months)* | *Item Scoring* | *p > \|r\| under Ho:Rho=0* | *Functional Grade* | *p > \|r\| under Ho:Rho=0* |
| 1 | 0.25028 | $p<0.01$ | 0.36007 | $p<0.001$ |
| 4 | 0.46371 | $p<0.001$ | 0.56533 | $p<0.001$ |
| 8 | 0.60962 | $p<0.001$ | 0.63953 | $p<0.001$ |
| 12 | 0.72981 | $p<0.001$ | 0.87318 | $p<0.001$ |

at the overall score to establish predictive validity.

## Discussion

Physiotherapists require an assessment suited to their needs that is, one which not only identifies the child who has problems but also provides information about the nature of the dysfunction and how it is affecting the child's abilities. The NSMDA meets these needs. This assessment procedure, by recording the quality of performance of particular activities, is capable of providing considerable insight into what the child can do as well as how the action is performed.

Furthermore, it is capable of distinguishing those children whose motor development falls within the accepted range of normal from those who have subtle as well as more serious disabilities of movement.

The assessment tests the same aspects of neuro-sensory motor development at each age, and yields results which are consistent over time. Therefore it allows longitudinal follow-up of children which is particularly important in the high risk groups. In fact this testing format has been used in longitudinal follow-up studies of approximately 800 children over the past 14 years.

Despite doubts about the value of early assessment for later prediction of outcome expressed by some authors (Bee *et al* 1982, McCall 1979), in a very large population study Drillien *et al* (1988) found that early adaptive and neurological screening tests provided the best indicators of behavioural and educational problems in children of six and a half and seven and a half years of age.

The consistency of results in this study up to two years and of similar previous studies to four and five years (Burns *et al*, 1987, 1984) supports the findings of Drillien and colleagues.

However, it is important to recognize the inconsistency of results of VLBW and very preterm infants in the first six months.

This variability of performance in the first few months is possibly a reflection of the perinatal difficulties experienced by many of the children. It could also reflect a reduction in handling, which is often a practical requirement in Neonatal Intensive Care Units. Powell (1974) found that differences which existed between infants in control (normal handling) and experimental groups (increased handling), had resolved by the age of six months.

## Conclusion

It can be seen from the results and discussion presented here that the NSMDA is suitable for longitudinal studies and appropriate for use with preterm infants and children. It has been shown to be reliable when used by different examiners, and to be capable

**Table 5:**
**Longitudinal correlations: Correlation of NSMDA scores at each assessment with scores at 2 years**

| Adjusted Age (months) | NSMDA Score Components Item Scoring | p > \|r\| under Ho:Rho | Functional Grade | p > \|r\| under Ho:Rho=0 |
|---|---|---|---|---|
| Gross motor | | | | |
| 1 | 0.37589 | $p<0.001$ | 0.39661 | $p<0.001$ |
| 4 | 0.40915 | $p<0.001$ | 0.39995 | $p<0.001$ |
| 8 | 0.47851 | $p<0.001$ | 0.41174 | $p<0.001$ |
| 12 | 0.63902 | $p<0.001$ | 0.77529 | $p<0.001$ |
| Fine motor | | | | |
| 1 | not tested | | not tested | |
| 4 | 0.28174 | $p<0.01$ | 0.29396 | $p<0.01$ |
| 8 | 0.28174 | $p<0.01$ | 0.37085 | $p<0.001$ |
| 12 | 0.39148 | $p<0.001$ | 0.63306 | $p<0.001$ |
| Neurological | | | | |
| 1 | 0.30769 | $p<0.001$ | 0.32182 | $p<0.001$ |
| 4 | 0.21558 | $p<0.05$ | 0.33770 | $p<0.001$ |
| 8 | 0.23951 | $p<0.01$ | 0.38918 | $p<0.001$ |
| 12 | 0.56806 | $p<0.001$ | 0.66569 | $p<0.001$ |
| Primitive reflexes | | | | |
| 1 | 0.19222 | $p<0.05$ | 0.06100 | ns |
| 4 | 0.27496 | $p<0.01$ | 0.37175 | $p<0.001$ |
| 8 | 0.37991 | $p<0.001$ | 0.42470 | $p<0.001$ |
| 12 | 0.51523 | $p<0.001$ | 0.68156 | $p<0.001$ |
| Postural | | | | |
| 1 | 0.02725 | ns | 0.03982 | ns |
| 4 | 0.30428 | $p<0.001$ | 0.35253 | $p<0.001$ |
| 8 | 0.43655 | $p<0.001$ | 0.41413 | $p<0.001$ |
| 12 | 0.63441 | $p<0.001$ | 0.57670 | $p<0.001$ |
| Sensory motor | | | | |
| 1 | 0.04222 | ns | 0.31457 | $p<0.001$ |
| 4 | 0.38501 | $p<0.001$ | 0.51447 | $p<0.001$ |
| 8 | 0.41357 | $p<0.001$ | 0.54874 | $p<0.001$ |
| 12 | 0.40081 | $p<0.001$ | 0.64248 | $p<0.001$ |

of distinguishing children's motor development within normal range from development with minor and major deviations. The method of scoring achievement of activity and quality of the movements used (item score) and the use of a child's performance (functional grade), allows the NSMDA to be used as an assessment tool, as well as a baseline from which progress can be monitored and treatment programmes planned.

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## Appendix 1

### NSMDA — Item Scoring

A. 1 Month (4-6 weeks adjusted age)

| *Area evaluated* | *Test Items* |
|---|---|
| 1. Gross Motor | Basic posture supine<br>Prone ability to turn head<br>Supported — sitting (firm surface)<br>— standing (firm surface)<br>General spontaneous motor activity |
| 2. Neurological | Basic tone (resistance to passive movement)<br>Tendon reflexes<br>Clonus<br>Tremor |
| 3. Primitive Reflexes | Grasp — hand<br>— foot<br>Foot withdrawal<br>Crossed extension<br>Extensor thrust (magnet)<br>Galant<br>Abdominal<br>Moro (head drop)<br>Asymmetrical tonic neck reflex<br>Tonic labyrinthine — supine<br>— prone<br>Walking (stepping)<br>Crawling (prone)<br>Adductor reflex |
| 4. Postural | Placing — hands<br>— feet<br>Supporting — hands<br>— feet<br>Head righting (ventral suspension) |
| 5. Sensory Motor | Tactile (light touch)<br>Proprioceptive — pressure (extension)<br>— traction (flexion)<br>Vestibular — oculo-motor<br>— response<br>— postural reaction<br>Ocular-motor — eye movement |

B. 4 months (16-20 weeks adjusted age)

| *Area evaluated* | *Test Items* |
|---|---|
| 1. Gross Motor | Basic posture supine<br>Spontaneous movement — arms<br>— legs (kicking)<br>Support on elbows<br>Supported — sitting<br>— standing<br>Rolling |
| 2. Fine Motor | Grasp — voluntary<br>— quality |
| 3. Neurological | Basic tone (resistance to passive movement)<br>Tendon reflexes<br>Clonus<br>Tremor |
| 4. Primitive Reflexes | Grasp — hand<br>— foot<br>Crossed extension<br>Galant<br>Abdominal<br>Moro (head drop)<br>Asymmetrical tonic neck reflex<br>Tonic labyrinthine — supine<br>— prone<br>Adductor reflex<br>Extensor thrust |
| 5. Postural | Placing — hands<br>— feet<br>Supporting — hands<br>— feet<br>Head righting — vertical<br>— horizontal<br>Landau (head and shoulders) |
| 6. Sensory Motor | Tactile (light touch)<br>Proprioceptive — pressure (extension)<br>— traction (flexion)<br>Vestibular — oculo-motor reflex<br>— postural reaction<br>Ocular-motor — horizontal<br>— vertical<br>— circular<br>— convergence |

C. 8 Months (32-36 weeks adjusted age)

| *Area evaluated* | *Test Items* |
|---|---|
| 1. Gross Motor | Basic posture supine<br>Pull to sit<br>Back/trunk extension<br>Ability to sit<br>Sitting posture<br>Supported standing (held to stand)<br>Assisted walking<br>Rolling (both directions)<br>Crawling (progression on hands and knees) |
| 2. Fine Motor | Grasp — type<br>— quality |
| 3. Neurological | Basic tone (resistance to passive movement)<br>Tendon reflexes<br>Clonus<br>Tremor |
| 4. Primitive Reflexes | Moro<br>Galant<br>Extensor thrust<br>Asymmetrical tonic neck reflex<br>Tonic labyrinthine — supine<br>— prone<br>Adductor reflex<br>Other |
| 5. Postural | Placing — hands<br>— feet<br>Supporting — hands<br>— feet<br>Head righting — vertical<br>— horizontal<br>— horizontal to L/R sides<br>Landau (full extension)<br>Parachute<br>Protective extension arms — sideways |
| 6. Sensory Motor | Tactile<br>Vestibular — oculo-motor reflex<br>— postural reaction<br>Ocular-motor — eye follow<br>— convergence<br>— eye-hand co-ordination |

D. 12 Months (48-54 weeks adjusted age)

| *Area evaluated* | *Test Items* |
|---|---|
| 1. Gross Motor | Basic posture supine<br>Sit from supine<br>Sitting<br>Rolling<br>Prone progression<br>Standing<br>Cruising (furniture walking)<br>Walking |
| 2. Fine Motor | Type of grasp<br>Manipulative ability<br>Awareness of two hands |
| 3. Neurological | Basic tone (resistance to passive movement)<br>Tendon reflexes<br>Clonus<br>Tremor |
| 4. Primitive Reflexes | Integration |
| 5. Postural | Head righting — vertical<br>— forward<br>— back<br>— side<br>— horizontal<br>— prone<br>— supine<br>— side<br>Landau (full trunk and hip extension)<br>— arms<br>— forward<br>— back<br>— side<br>— parachute (reaction in legs) |
| 6. Sensory Motor | Tactile<br>Vestibular — oculo-motor reflex<br>— postural reaction<br>Ocular-motor — eye follow (horizontal, vertical, circular, convergence)<br>— rolling ball test<br>— eye-hand co-ordination |

E. 24 Months (23-25 months adjusted age)

| *Area evaluated* | *Test Items* |
|---|---|
| 1. Gross Motor | Sitting<br>Walking — type<br>— quality<br>Kneeling<br>Balance |
| 2. Fine Motor | Hand grasp<br>Eye-hand co-ordination |
| 3. Neurological | Basic tone (resistance to passive movement)<br>Tendon reflexes<br>Clonus<br>Tremor/involuntary movement |
| 4. Primitive Reflexes | Integration |
| 5. Postural | Head righting — vertical<br>— forward<br>— back<br>— side<br>— horizontal<br>— prone<br>— supine<br>— side<br>Landau (head and body)<br>Balance reactions — protective reactions — arms — forward<br>— back<br>— side<br>— legs — parachute<br>Equilibrium — sitting<br>— standing |
| 6. Sensory Motor — | Tactile<br>Vestibular — oculo-motor reflex<br>— postural reaction<br>Ocular-motor — eye follow<br>— rolling ball test |