Developmental Coaching of the Down Syndrome Infant

(adaptation, activities of daily living, mental retardation, teaching)

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Proprioceptive input appropriate to the developmental level of the Down Syndrome infant, and kinesthetic and proprioceptive leading of the infant enhance joint stability and prompt the infant to participate in a fuller repertoire of exploratory movement at a relatively early developmental age. Comparison of performances of the Down Syndrome population at the Ray Graham—Fairwood School with that of other Down Syndrome infants in the literature suggested that our intervention program, developmental coaching, had made a difference. A retrospective study was undertaken to document the progress made. Of the 40 infants studied, 95 percent achieved certain hand skills criteria by 10 months of age; 92.5 percent achieved prewalking mobility by 10 months of age; and 40 percent achieved free walking by 18 months of age.

Current literature supports the contention that Down Syndrome (DS) children have potentials that can be developed under optimal home conditions. Despite genetically based limitations, these children can learn to care for their daily living needs and perform other useful functions. Further, they are capable of adaptive development and learning from a structured training program (1-12).

An assumption of the early intervention service at the Ray Graham—Fairwood School in Lombard, Illinois, is that early intervention with “at-risk” infants is meaningful to both the infants and their families. An early intervention strategy that we use is best described as developmental coaching.

Developmental coaching consists of a background knowledge of infant development together with a sensitive observation of infant performances so that the unique behaviors that are effective for each infant are solicited in response to his or her involvement with developmentally appropriate tasks. This coaching addresses the infants at their current level of development in five task areas by means of a prompting process. Using gross and fine motor activities, daily living skills, language, and socialization experiences, these infants are led through a regimen of developmentally appropriate tasks toward an improved integration of physical and adaptive skills. Parents are present and are taught this method of handling their children.

After using the developmental coaching strategy for a period of time, we observed some positive results. A review of the clinical observations recorded in my occupational therapy notes and of the Bayley evaluations (13) suggested that two treatments had encouraged developmental progress in the DS infants: (a) Proprioceptive input appropriate to the developmental level of the infant enhanced joint stability; and (b) kinesthetic and proprioceptive leading prompted the infant toward early participation in an expanded repertoire of exploratory movement.

In order to examine these positive gains more objectively, the de-

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velopmental level of the DS infants enrolled in our program from 1973 to 1978, all of whom had received developmental coaching, was compared with those DS infants reported in the literature of that same time period (3-8, 11, 12, 14) who had not received developmental coaching. The literature was reviewed, and a retrospective study was conducted to examine the usefulness of developmental coaching of these infants and their parents.

**Literature Review**

*Down Syndrome Delimited.* The literature identifies the problems examined in this study—hype mobility of the joints and depressed muscular tone—as two of the more common signs of DS. Data published in the decade of the 1970s generally agree that DS developmental scores from 0 to 6 months of age are comparable to normal ranges (2, 3, 6, 7, 9, 15). A sharp decline occurs in test performance of both mental and motor development between the ages of 6 and 10 months. The decline becomes more gradual from the ages of 10 months to 2 years. Although the mental and motor skills of DS children can vary over a wide range, by 2 years of age the children lag developmentally by nearly a full year. Poor motor skills, however, do not necessarily mean more severe retardation (15-17).

**Influence of Specificity in the Process of Development.** The young child’s central nervous system (CNS) goes through an organizational process characterized by plasticity and rapid development. Therefore, early intervention is thought more likely to result in improved responses to training (18). A careful arrangement of specific intervention processes that can be used to guide the DS child is needed. Just what this arrangement of early intervention processes should be is in order to circumvent anticipated problems in the DS child needs to be recommended by research (18).

Specific interventions have a qualitative aspect that allows for unique fitness to a particular child with a special problem. Three researchers established that special attention should be paid to the quality of the task used in training. Kopp (19) concluded that the quality of normal fine motor behavior influences the use of objects and that meaningful manipulation provides attentional and informational value for children. Similarly, Lydic (8) established that self-rotation along the body axis is essential to the achievement of normal quality movement in coming to sitting and using normal gait patterns. She cited Connally and Russell as emphasizing that hypotonia be normalized in DS children before attempting to achieve mobility milestones. Thus there are behaviors preceding effective mobility, and Lehr (20) describes these as: (a) movement into the position required for a specific type of mobility; (b) stability in that position; (c) movement in that position; (d) locomotion in that position; and (e) movement out of that position.

Because this study concerns motor and sensory learning in infancy, it is important to recognize that infant learning mechanisms are not found in the usual isolated response concept of learning in which reinforcement and shaping by repetition under reinforcing conditions strengthen the response. Instead, one looks for the important qualitative changes in the motor pattern that may reflect some interaction between innate response mechanisms and environmental input. Progress in infant learning is in jumps of qualitative organization and reorganization (21).

**Self-Involvement of the Learner,** Bruner (21), in agreement with Piaget, White, Castle, and Held, describes the voluntary use of the hands as dependent on the development of a sensorimotor schema. The schema is constructed of inputs that coordinate visual sensibility and physical movement. Feedback circuits must be developed within the learner to permit self-coordination. The learner has to be able to pause and hold a position briefly at each stage of movement (19, 21). This pause provides a special time for adaptation.

An understanding of this total coordination process offers insight into dealing with the DS problems of hypotonia and hypermobility of the joints. This process of specificity and self-involvement would account for the quality of developmental improvement seen in our study population.

**Rationale and Technique**

Our observation of many DS infants revealed that there were certain hand and mobility items on the Bayley scales (13) that indicated the achievement of a learning stage appropriate for intervention in order to counteract deficits, ranging from lack of interaction with objects and materials to inability to maintain sustained and purposeful contact with objects and materials. The hand skills targeted for consideration were: (1) reaches for dangling ring; (2) reaches for cube; and (3) bangs in play. These three skills require the
ability to stabilize the neck and shoulder joints for directing the movement and for achieving instrument or tool use of the arm(s).

The mobility skills targeted were: (1) Prewalking progression; (2) pulls to standing; and (3) walks alone. These three skills require a progression from pivoting in prone on the floor through the hand/knee creep to standing and upright mobility. They further require an increasing degree of weight-bearing stabilization of the spinal column, shoulder, and hip joints in the integrated skill of performing weight bearing while achieving the tool use of the body as a mobile unit.

Besides the basic general objectives of improving therapeutic function leading to active performance, the occupational therapist's rationale and techniques for resolving the problems created by the hypermobility of the joints and by hypotonia in the DS infant are:

1. To enhance joint stability, and to assist and guide the infant toward awareness and involvement in position sense activities. The therapist uses a technique best described as hands-on, infant-directed play. Play is used because the infant should be able to respond spontaneously with as much enjoyment as possible.

2. To encourage movement, and to assist and guide the infant toward awareness and involvement in directed motor activity. Again the technique used is hands-on, infant-directed play.

For the optimal learning effect, the range of problems and the way the individual infant responds both directly affect the way in which the infant is handled. Our intervention program is implemented cautiously and selectively based on the feedback given by the infant, by the family, and by the teacher.

Retrospective Study

A record search was made on more than 100 DS infants who had been enrolled in our program from 1973 to 1978. Of this number only 65 had data that included birthdate, age on entering the program, and sex. The data and age distribution for this group of 65 infants is recorded in Figure 1.

The subjects cluster into two groups: early admissions (8 months of age or under); and late admissions (over 10 months of age). Sex was equally distributed, so no further separation of data was maintained.
The records of only 57 of the 65 infants included data of the initial evaluation. The records of only 40 of the 57 included data of the second evaluation. The data for these groups are recorded in Figures 2, 3, and 4.

Figure 2 shows the hand skills that these infants failed on the Bayley scales (13) at the time of the initial and second evaluations. If the normal ranges are eliminated, some delay in the acquisition of hand skills is apparent at the initial evaluation. By the second evaluation, the records indicate only 2 of 40 infants lacked one-hand skill.

Figure 3 shows the mobility skills that were failed on the Bayley scales (13) at the time of the initial and second evaluations. Again, eliminating the normal ranges, an increased number of failures for the mobility skills is seen when joint stability and coordinated muscular action against gravity are involved in the development of skills.

Figure 4 shows the average number of hand and mobility skills acquired at the first and second evaluations. At the first evaluation, hand skills are slightly delayed and appear in a normal progression for the early admission subjects. For the later admission subjects where both hand and mobility skills are accountable, the progression is erratic and delayed.

At the second evaluation, both early and late admission subjects are grouped together, so no clearcut differentiation appears in the graph. The erratic response of the DS infants up to the age of 3 years becomes apparent. Even with this erratic response there is a notable trend for an earlier achievement of developmental skills by 18 months of age.

In Figure 5 the early admission subjects at their second evaluation are compared with the late admission subjects at their first evaluation. The comparison shows that 65 percent of early admission subjects were free walking as compared to 31 percent of the late admission subjects, and that 90 percent of the early admission subjects passed all other criteria as compared to 81 percent of the late admission subjects. These evaluations were performed between the 18- and 30-month span.
Discussion

The findings of this retrospective study support the findings in the literature: DS infants show a slower than normal rate of development. However, the achievement rates of the subjects in this study are more accelerated than those found in the literature. By the second evaluation of the six skills tested, which affirmed the performance levels of DS infants, the scores are comparable to normal ranges up to 11 months of age. By age 10 months, 95 percent of the study subjects achieved the full range of skills, and 92.5 percent achieved prewalking. By age 13 months, 70 percent achieved the pulls-to-stand skill. By age 18 months, 40 percent achieved free walking. Although the performance of the study subjects is inconsistent between 11 and 32 months of age, the full-year lag cited in the literature for the 24-month level of performance is not corroborated by our findings. Sixty percent of the study subjects have the potential or are achieving all of the six criteria skills by 17 months of age.

A comparison of study results with the results of other reports on specific skill achievement follows. Direct comparisons were not possible because of differences in reporting styles.

Carr (14, and by private communication, January 10, 1980), in reporting periodic evaluations for a population of 46 DS infants raised at home, found that at 10 months of age hand skills were attained by 80 percent of those examined. The mobility skills of those examined by 15 months of age are itemized: (1) 37 percent achieved prewalking skills; (2) 38 percent achieved pulls-to-stand; and (3) none walked alone (21). Our program of developmental coaching produced more notable improvements.

Using 12 DS subjects, Hanson (4) compared the skills of those in an intervention program with the skills attained by those raised at home (4). For the ability to transfer objects, those in the intervention program achieved the skill between 4 and 8 months, as compared to those raised at home who achieved it between 5 and 41 months. For prewalking mobility, those in the intervention program established the skill between 8 and 21 months, as compared to those raised at home who achieved prewalking between 7 and 44 months. For pulls-to-stand, those in the intervention program achieved the skill between 8 and 18 months, as compared to those raised at home who achieved the skill between 7 and 48 months.

Our study corroborates Hanson’s findings regarding hand skills of those subjects in the intervention program. However, we appear to have been more successful with mobility skills through the developmental coaching program than Hanson was through the intervention program.

Zausmer’s (12) intervention with 23 DS infants had the following results: For the ability to reach and transfer, 56 percent achieved the skill by 18 months; for the ability to free walk, 17 percent achieved the skill between 12 and 18 months of age. Our intervention program appears to have been more successful for both hand and mobility skills than was Zausmer’s program.

Conclusion

A comparison between the early and the late enrollees in our study and a comparison between the study population of 40 DS infants and reports from the literature indicate the following conclusions:

1. Developmental delay in the DS population was verified.
2. The wide time range over which DS infants acquire skills was confirmed.
3. The response of young DS infants (less than 9 months) to specific developmental coaching demonstrates more effective results than the response of DS infants more than 9 months of age.
4. Training for self-controlled stability and for quality movement prompts the infant to participate in a fuller repertoire of exploratory movement at a relatively early developmental age.
5. Specific intervention involving the infants and their caretakers makes a significant difference in the DS infants’ acquisition of basic developmental skills.
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