CASE REPORT

An Intervention Program for a Fraternal Twin With Down Syndrome

Sandra J. Edwards, Hon Keung Yuen

Key Words: developmental therapy • neurodevelopmental therapy • patient care team • physical stimulation

TWO of the current therapeutic intervention modalities that have been widely used for the treatment of persons with developmental disabilities are neurodevelopmental treatment and sensory stimulation (Harris, 1987; Pother & Cheek, 1984). The effects of these treatments on the sensorimotor performance of infants and children with Down syndrome have been inconsistent (Harris, 1981; Kantner, Clark, Allen, & Chase, 1976; Lydic, Windsor, Short, & Ellis, 1985; MacLean & Baumeister, 1982). For example, Harris (1981) and Lydic et al. (1985) were unable to demonstrate significant improvement in the motor performance of children with Down syndrome after administering either neurodevelopmental treatment or vestibular stimulation. Vestibular stimulation is regarded as an essential component in sensory stimulation due to its hypothesized positive effect on hypotonicity, which is so commonly observed in children with Down syndrome. Additionally, children with Down syndrome have been observed to have increased alertness after receiving calibrated rotary vestibular stimulation (Lydic et al., 1985).

We incorporated both neurodevelopmental treatment techniques (Bobath & Bobath, 1976) and vestibular and tactile stimulation techniques (Ayres, 1979) into an intervention program for a girl with Down syndrome who was the second born of fraternal twins. "If a child is generally hypotonic, considerable amounts of excitatory tactile and vestibular stimuli are in order and few precautions are necessary." (Ayres, 1979, p. 118). Our objective was to facilitate her motor, reflex, prelinguistic, and cognitive development. We also used a transdisciplinary approach, as advocated by McCormick and Goldman (1979). This approach required a collaborative treatment planning effort across disciplines and left the implementation of the treatment to a single team member.

Case History

This female twin weighed 2,954 g at birth and was born breech. Two days after birth, she was admitted to the hospital because of weak sucking and swallowing reflexes, and tube feeding was required. During this hospitalization, examinations revealed that the child had group B streptococcic sepsis and questionable seizure disorder; however, no abnormality showed in an electroencephalogram. When the child was 2 months old, an atrial septal defect was detected and treated with digoxin until she received a cardiac catheter. A history of recurring bilateral otitis media and upper respiratory tract infections since birth were reported by the nurse practitioner.

Family Background

The twin brother weighed 3,210 g at birth, had no difficulty during birth, and was confirmed by a genetic
examination to be chromosomally normal. When the twins were born, the mother was 35 years old and in the 37th week of gestation. During her pregnancy, the mother had been on medications to control seizures and a thyroid malfunction.

The physical and medical problems of the twin with Down syndrome and the responsibilities involved in raising twins were a challenge for this single mother. In addition, she had limited social and financial resources, which could have a negative effect on her parenting skills.

Preintervention Evaluation

The female twin was evaluated at 11 months 6 days of age with the Bayley Scales of Infant Development (Bayley, 1969), reflex testing (Bleck, 1975), the oral and feeding assessment (Coley, 1978), the Receptive Expressive Emergent Language Scale (Bzoch & League, 1970), the Sequenced Inventory of Communication Development (Hedrich, Prather, & Tobin, 1984), clinical observation, and neuromuscular examinations. All evaluations were administered in the child's home to obtain a natural sampling of her behavior. They were completed by the first author, who is certified in sensory integration testing, and by a speech-language pathologist.

To establish the interrater reliability of the Bayley Scales of Infant Development, a registered occupational therapist with extensive pediatric experience, who was unaware of the purpose of the study, sat next to the first author and rated the Bayley scales independently as the child was evaluated. A 100% agreement in scoring was achieved in all areas of the Bayley scales evaluations. The percentage of agreement for interobserver reliability was calculated as follows:

\[
\text{Percentage of Agreement} = \frac{\text{no. of agreed items}}{\text{no. of agreed items} + \text{no. of disagreed items}} \times 100
\]

The results of the Bayley scales are shown in Tables 1 and 2.

Reflex testing indicated the presence of several primitive reflexes and the absence of sitting equilibrium and optical righting reactions in tilting (see Table 3). The combined motor and reflex delays warranted the use of neurodevelopmental treatment. The correlation of the low score on the Bayley Motor Scale (5.5 months) and the poor postural reactions of the child was consistent with Haley's (1986) findings.

On the basis of clinical observation, we found that the child demonstrated tactile defensiveness by withdrawing from being touched and resisting toys hidden in rice. She also demonstrated signs of vestibular dysfunction, as evidenced by her poor sitting balance and her withdrawing or crying when engaged in such vestibular stimulation as slow spinning, rocking, and rolling. These signs indicate a need for vestibular stimulation (Montgomery, 1985).

An oral-motor assessment showed poor sucking and swallowing responses, strong bite reflex, tongue protrusion, and other oral-motor dysfunctions (see Table 3).

Neuromuscular examinations revealed low muscle tone, as demonstrated by hyperextension of the finger and wrist joints, excessive dorsiflexion of the ankles, hyperabduction and flexion of the hip joints, and noticeable lordosis of the back. Extreme hypotonia has been correlated with the absence or persistence of some of the pathological reflexes in children with Down syndrome (Cowie, 1970).

The child scored 3 months behind her age level in both receptive and expressive language on the Receptive Expressive Emergent Language Scale and the Sequenced Inventory of Communication Development.

<table>
<thead>
<tr>
<th>Mental</th>
<th>Preintervention</th>
<th>Postintervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw score</td>
<td>78</td>
<td>93</td>
</tr>
<tr>
<td>Mental Development Index</td>
<td>52</td>
<td>&lt;50</td>
</tr>
<tr>
<td>Age equivalent (months)</td>
<td>4.5</td>
<td>10.0</td>
</tr>
<tr>
<td>Developmental quotient</td>
<td>40.90</td>
<td>47.62</td>
</tr>
<tr>
<td>Motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw score</td>
<td>25</td>
<td>38</td>
</tr>
<tr>
<td>Psychomotor Development Index</td>
<td>&lt;50</td>
<td>&lt;50</td>
</tr>
<tr>
<td>Age equivalent (months)</td>
<td>5.5</td>
<td>9.0</td>
</tr>
<tr>
<td>Developmental quotient</td>
<td>50.00</td>
<td>42.86</td>
</tr>
</tbody>
</table>

Note. Developmental quotient = (age equivalent/chronological age) \times 100. The child's chronological age before intervention was 11 months; after intervention, 21 months.

<table>
<thead>
<tr>
<th>Table 2: A Comparison of the Infant Behavior Record* Before and After Intervention for the Twin With Down Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preintervention</td>
</tr>
<tr>
<td>Displays little body motion</td>
</tr>
<tr>
<td>Is accepting</td>
</tr>
<tr>
<td>Watches warily</td>
</tr>
<tr>
<td>Bangs toys infrequently</td>
</tr>
<tr>
<td>Does not mouth toys</td>
</tr>
</tbody>
</table>

* From the Bayley Scales of Infant Development (Bayley, 1969).
meet both disciplines' goals and objectives (see Table 4) and to efficiently use the child's limited attention span and energy. We adapted programming resources from Developmental Programming for Infants and Young Children (Schafer & Moersch, 1981) and Time to Begin: Early Education for Children With Down Syndrome (Dmitriev, 1982). Preparation time for the programming (after the initial assessment) took approximately 2 weeks.

A home-based program was selected to promote the parent's participation. A home interventionist implemented the treatment under the supervision of the first author and of a faculty member in the speech-language pathology department.

Treatment consisted of weekly 30-min sessions for a 9½-month period. The parent observed and participated in treatment, and the rationales for each intervention were discussed and explained to her.

To facilitate gross motor skills, the home interventionist stimulated the child's sitting equilibrium and optical righting reactions in tilting. The child was positioned in a cross-legged sitting style and gently pushed on either side at shoulder level to challenge her sitting equilibrium. To strengthen the trunk muscles, stimulation such as tapping and vibrating were applied to the extensor muscles on either side of the spinal column. In addition, techniques described by Bobath (1969) were used to place the child in prone and 4-point kneeling positions in order to facilitate righting and equilibrium reactions in the quadruped and sitting positions.

Because the child was resistant to vestibular and tactile stimulation, both were introduced slowly and carefully. The home interventionist began vestibular stimulation by holding the child in her lap and rocking her side to side and back and forth. Gradually, the child was seated in a snow dish and spun slowly for 2 to 2½ revolutions while her nystagmus responses were observed. After 4 months of holding and gentle spinning, the home interventionist introduced a rubber rocking horse for vestibular stimulation.

Tactile stimulation was implemented through a search for objects of various sizes hidden in rice. At first, the child was resistant to this type of tactile experience but, through a gradual introduction, she became more responsive to it. The child also accepted firm pressure on her hands and demonstrated less defensiveness to it than she did to light stroking.

The development of eye-hand coordination was facilitated by the use of an enlarged pegboard with pegs 2 cm in diameter to foster success in placing

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**Table 3**

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Preintervention</th>
<th>Postintervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moro</td>
<td></td>
<td>±</td>
</tr>
<tr>
<td>Parachute</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Neck righting</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Asymmetrical tonic</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>neck reflex</td>
<td></td>
<td>±</td>
</tr>
<tr>
<td>Extensor thrust</td>
<td></td>
<td>±</td>
</tr>
<tr>
<td>Foot placement</td>
<td></td>
<td>±</td>
</tr>
<tr>
<td>Symmetrical tonic</td>
<td></td>
<td>±</td>
</tr>
<tr>
<td>neck reflex</td>
<td></td>
<td>±</td>
</tr>
<tr>
<td>Landau</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Optical righting</td>
<td>±</td>
<td>+</td>
</tr>
<tr>
<td>Feeding</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Rooting reflex</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Sucking reflex</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Swallowing</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Bite reflex</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Tongue protrusion</td>
<td>±</td>
<td>±</td>
</tr>
</tbody>
</table>

*Note:* = absent; + = present; ± = beginning or fading. *Indicates a maturation in development.

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**Table 4**

**Sample of Intervention Activities**

**Net Activity**

Materials: Low-hanging vestibular net, objects.

Position: Prone, supine, side-lying, or sitting.

Procedure: Encourage child to push with hands to swing self in net; child may reach for objects.

Place different textures on ground to increase tactile stimulation. Alternatively, simply swing or twirl the child.

Goals: *Occupational therapy.* Improve neck cocontraction, facilitate back extension, facilitate labyrinth righting and sitting equilibrium reaction, stimulate tactile sense, stimulate utricle and saccule of the vestibular system, facilitate weight bearing and shifting.

*Speech therapy.* Gesture and vocal imitation; associated bubbling for imitation.

**Bubble Activity**

Materials: Soap bubbles.

Position: Child placed in sitting position, supported at hips; therapist positioned to side of child.

Procedure: Blow bubbles and produce the word *more,* prompt child to approximate the word *more,* when approximation is made, present bubbles at the child's side and encourage the child to pop bubbles with opposite hand.

Goals: *Occupational therapy.* Improve sitting equilibrium and labyrinth righting reactions, increase trunk rotation, upgrade weight shift for mobility.

*Speech therapy.* Word or gesture approximation.

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pegs on the board. To encourage eye tracking, the home interventionist blew soap bubbles in specific directions.

To facilitate oral-motor function, the home interventionist placed peanut butter on the lateral side of the child's tongue to facilitate tongue movement and lip closure. Crackers were introduced on either side of her mouth to encourage chewing. Different shapes of cups were introduced to encourage mouth closure that allowed her to swallow liquid.

The home interventionist used language to encourage vocalization and to imitate the child's and the brother's sounds. A mirror was placed in front of the child to augment visual feedback so she could see the formation of the adult's lips when the adult made sounds. The adult was seated on the floor behind the child to augment positioning of the lower extremities and trunk and to simultaneously talk to the child. Using the mirror, the child could see the adult's lips and be kept in a desirable developmental position for sitting. The mother was encouraged to facilitate language by asking the child to make a sound instead of a gesture for an object.

Besides providing therapy for the child, the home interventionist demonstrated to the mother how to stimulate and facilitate the child's motor, cognitive, and prelinguistic development as a carryover of the home program. Strategies to deal with the child's behavioral problems and to discipline the brother were discussed and implemented. For instance, after discovering that the mother sometimes punished the children by sending them to bed with no supper (the children were underweight), the home interventionist recommended an alternative disciplinary action of time out in the bedroom for shorter periods of time to accomplish the necessary discipline without sacrificing the loss of a healthy meal. The mother used this suggestion.

The child also attended an hour each of special education and physical therapy twice a week in a public school. Over the 9½-month period of the intervention, neither occupational therapy nor speech-language therapy was provided in the school program. Objectives from the special education teacher and the physical therapist were incorporated in treatment planning. The intervention and school program began within 2 weeks of each other.

Postintervention Evaluation

The child was reevaluated at the age of 21 months 5 days after 9½ months of intervention. An analysis of the developmental quotient from the Bayley Scales of Infant Development in preintervention and postintervention evaluations showed a gain in the Mental Scale of 6.72 points (see Table 1).

A comparison of the child's behaviors before and after intervention showed that some improvement had occurred (see Table 2). The child appeared more relaxed, attentive, confident, and interested in the activities, and she responded more readily to the examiner during the reevaluation (e.g., she was smiling and interacting, moving a lot more, and acting more sociable). The child's attention span for playing with and manipulating toys increased from seconds at the beginning of therapy to 5–7 min at the end of therapy. She also played more purposefully. For example, before the initiation of therapy, the child would throw blocks without interest or attention; with therapy, she developed more interest in banging them, stacking them, and watching where they landed when she threw them.

Improvement was observed in the foot placement response and in the optical righting reaction. The feeding evaluation showed an inhibition of the biting reflex, less tongue protrusion, and an improvement in sucking reflex (see Table 3). The mother and home interventionist reported that the child was generally easier to feed.

The results of the language development evaluation, as reported by the speech-language pathologist, indicated that the child demonstrated a gain of 3 months in her expressive language score but made no gain in her receptive language score.

Discussion

Prior studies with standardized developmental tests have shown that children with Down syndrome exhibit a pattern of a decreasing rate of development throughout infancy and early childhood in both the mental and motor domains (Carr, 1970; Dicks-Mireaux, 1966, 1972). Hanson (1981) reported a gradual decline in scores on the Bayley Scales of Infant Development over the first 2 years, particularly in the area of motor development. This was true even for Down syndrome children who had participated in an intervention program.

The present study suggests that occupational therapy through home intervention and the incorporation of neurodevelopmental treatment and vestibular and tactile stimulation techniques have successfully decreased the decline in the development of a child with Down syndrome, as determined by the age equivalent scores on the Bayley Scales of Infant Development and on reflex testing. We cannot, however, eliminate the possibility of maturation or the effects of physical therapy and special education as alternative explanations.

The home-based program gave the parent a better understanding of the abilities of the twin with Down syndrome, thus facilitating more realistic ex-
pectations and a more positive attitude toward the twin. Parental participation in intervention has been identified as an essential component in sustaining the gains from therapeutic intervention once the formal programming has ended (Hanson, 1977). After the intervention period, the parent in the present study reported that she gained more confidence and competence in her daily management of the child by using the emotional support provided by the home interventionist.

The transdisciplinary approach allows team members to share their professional expertise (Wolery & Dyk, 1984), thus avoiding the role conflicts and time clashes that result when team members feel they must defend their professional territories. Additionally, the possibility of overstimulating the child may be reduced.

The success of this intervention can be attributed to (a) the combining of the theoretical principles of neurodevelopmental treatment and vestibular and tactile stimulation, (b) the strategic planning and implementation of treatment through the team members’ collaboration (transdisciplinary approach), and (c) the inclusion of parental skills training as part of home-based treatment. ▲

Acknowledgments

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References


Editor’s Note. To continue the Case Report department, we need and welcome reports that document the practice of occupational therapy for specific clinical situations. Guidelines for writing case reports are available from the Editor.