

movement on the Assessment of Oral Movements During Feeding/Eating and Drinking subtest. His total score on this subtest also reflected moderate muscle dysfunction. On the Apraxia Inventory, he exhibited generally normal motor planning.

An informal speech sample was attained. At 21 months of age, Subject 2 produced nine individual phonemes as part of his babbling. These included seven consonants and two vowels: /m, w, b, p, d, k, z, a, and i/. This subject did not produce any true words or word approximations at this time.

Subject 3

Subject 3, a female with Down syndrome, has received consistent oral motor treatment three times daily since the age of 1 month as part of her home program. Both oral massage (Bahr, 2001) and Beckman Facilitation Techniques (Beckman, 1997) were completed three times daily. The following Beckman Facilitation Techniques (Beckman, 1997) were used: upper lip stretch, side-to-side upper lip stretch, lower lip stretch, side-to-side lower lip stretch, corner lip stretch, horizontal lip stretch, lip curl and stretch, resistive lip stretch, diagonal nasal bridge stretch, Z-stretch for the nasal bridge, mini "C" stretch, gum massage, upper cheek stretch, upper posterior cheek stretch, lower cheek stretch, lower posterior cheek stretch, masseter cheek stretch, and lateral pressure to the tongue. In addition to oral massage (Bahr, 2001) and Beckman Facilitation Techniques (Beckman, 1997), jaw exercises and the Sara Rosenfeld-Johnson Bubble Blowing and Straw Drinking Hierarchies (Bahr, 2001; Rosenfeld-Johnson, 1999) were used with this subject. Her family consistently used the recommended therapeutic feeding techniques. Other techniques to facilitate improved oral motor function and speech/sound production included tongue walking; vibration using a portable, hand-held massager; signing; and visual-tactile cueing.

Subject 3 was first seen for oral motor assessment at 4 months of age (pretest). On the Pre-Feeding Skills Checklist, (Morris & Klein, 2000), she attained six out of the seven feeding skills assessed at the 3-4 month level. She was fed in a semisitting position, sucked semisolids from a spoon, used a suckle-swallow pattern to move semisolid food to the pharynx, sequenced 20 or more sucks from the bottle, used a suckling pattern, and ate baby food cereals/pureed foods from a spoon. She did not take 7 or 8 ounces per feeding at four to six feedings per day. However, she reportedly took 5 ounces of liquid five to six times per day.

The Battery for Oral-Motor Behavior in Children (Long et al., 1998) was used as the posttest. Subject 3 was 20 months of age at the time of the posttest. She exhibited generally normal muscle function in jaw, lip, and tongue movement on the Assessment of Oral Movements During Feeding/Eating and Drinking subtest. Her total score on this subtest also reflected generally normal muscle function. On the Apraxia Inventory, she exhibited mild motor planning dysfunction.

An informal speech sample was attained. At 20 months of age, Subject 3 produced reduplicative babbling containing at least five different phonemes (i.e., /aebaeabae, laelaela, baebabou/). According to parental report, this subject also produced other sequences of reduplicative babbling. She consistently produced word approximations such as /hi/ for *hi*, /ʌb/ for *up*, and /pe/ for *pray*. However, she was reported by her mother to produce many other word approximations.

Subject 4

Subject 4, a female with Down syndrome, has not received consistent or frequent oral motor treatment as part of her home program. She began oral motor treatment at 4 months. Her oral motor treatment plan consisted of oral massage (Bahr, 2001) and Beck-

man Facilitation Techniques (Beckman, 1997). According to the parent questionnaire, the oral massage (Bahr, 2001) and Beckman Facilitation Techniques (Beckman, 1997) are no longer being used. The following Beckman Facilitation Techniques (Beckman, 1997) were reportedly used with the subject at some point in time: pressure to the base of the tongue, gum massage, lateral pressure to the tongue, stimulation to the midblade of the tongue, palate and tongue blade sweep, and inner-lower gum sweep for tongue tip elevation. Some of the demonstrated therapeutic feeding techniques were used with Subject 4. The subject was reportedly beginning to participate in the use of the Sara Rosenfeld-Johnson Bubble Blowing and Straw Drinking Hierarchies (Rosenfeld-Johnson, 1999). Her mother also considered the use of an electric toothbrush and regular toothbrushing as successful oral motor techniques.

Subject 4 was first seen for oral motor assessment at 4 months of age (pretest). On the Pre-Feeding Skills Checklist (Morris & Klein, 2000), she attained seven out of the seven feeding skills assessed at the 3–4 month level. She was fed in a semisitting position, took 7 or 8 ounces per feeding at four to six feedings per day, sucked semisolids from a spoon, used a suckle-swallow pattern to move semisolid food to the pharynx, sequenced 20 or more sucks from the bottle, used a suckling pattern, and ate baby food cereals/pureed foods from a spoon.

The Battery for Oral-Motor Behavior in Children (Long et al., 1998) was used as the posttest. Subject 4 was 23 months of age at the time of the posttest. She exhibited moderate muscle dysfunction in jaw, lip, and tongue movement on the Assessment of Oral Movements During Feeding/Eating and Drinking subtest. Her total score on this subtest also reflected moderate muscle dysfunction. On the Apraxia Inventory, she exhibited mild motor planning dysfunction.

An informal speech sample was attained. At 23 months of age, Subject 4 produced one individual phoneme (i.e., /mmm/) as part of her babbling. According to parental report, she produced three word approximations (i.e., /mam/ for *mom*, /dae/ for *dad*, and /dɔ/ for *dog*) and one true word (i.e., *up*).

Discussion

The hypothesis that young children with hypotonia who consistently and frequently receive an oral motor home program demonstrate improved oral muscle function for eating, drinking, and speaking was supported by the results of this descriptive, multiple case study. On the pretest, Pre-Feeding Skills Checklist (Morris & Klein, 2000), the two males and the two females had similar test results (see Table 3). The two boys each attained four of the six or seven skills assessed at the 3–4 month level.

Table 3. Pretest Results: Pre-Feeding Skills Checklist (Morris & Klein, 2000)

Subject	Subject 1 (male, consistent treatment)	Subject 2 (male, inconsistent treatment)	Subject 3 (female, consistent treatment)	Subject 4 (female inconsistent treatment)
Age	3 months	4 months	4 months	4 months
3–4 Month Level Assessed	4/6 skills present- spontaneous	4/7 skills present- spontaneous	6/7 skills present- spontaneous	7/7 skills present- spontaneous

The two girls attained six or seven of the seven skills assessed at the 3-4 month level. Therefore, the baseline scores were consistent for each gender. This means that the children, of each gender, in the study, began with basically the same oral motor skills.

There were apparent gender differences at the time of the pretest (i.e., the two girls had attained a few more feeding skills than the boys). However, despite these gender differences at an early age, the differences in oral motor function noted in posttesting appeared to be related to consistency of treatment as opposed to gender. Significant score discrepancies were noted between the subjects who received consistent treatment and those who did not receive consistent treatment. On the Assessment of Oral Movements During Feeding/Eating and Drinking portion of the posttest, Battery for Oral-Motor Behavior in Children (Long et al., 1998), the male and female who received a consistent home treatment program (Subject 1 and Subject 3) obtained scores reflecting generally normal muscle function in all areas tested. However, the male and female who received inconsistent treatment at home (Subject 2 and Subject 4) obtained scores reflecting moderate muscle dysfunction (see Table 4). These scores were obtained through the assessment of each child's eating and drinking skills. Therefore, these data substantiate the hypothesis regarding the improvement of oral muscle function for eating and drinking resulting from the use of a consistent oral motor home treatment program.

It was interesting to note that on the Apraxia Inventory portion of the Battery for Oral-Motor Behavior in Children (Long et al., 1998), test results were similar for three of the subjects (Subject 1, Subject 3, and Subject 4). Subject 2 (male receiving inconsistent treatment) actually obtained a score reflecting generally normal motor planning (see Table 4). Therefore, it does not appear that the oral motor intervention protocol significantly im-

pacted the motor planning skills of the four individuals of the study. However, it should be noted that not all subjects could complete all of the items on the Apraxia Inventory, because not all of the subjects had begun to talk at the time of the posttest. Subject 1 had 6 out of 12 characteristics of dyspraxia (7 items tested were speech related). Subject 2 had 3 out of 16 characteristics of dyspraxia (11 items tested were speech related). Subject 3 had 10 out of 21 characteristics of dyspraxia (16 items tested were speech related). Subject 4 had 6 out of 11 characteristics of dyspraxia (6 items tested were speech related).

Informal speech sample results indicated that the subjects who received consistent oral motor home treatment had greater overall speech output than those who did not receive consistent oral motor home treatment (see Table 5). With regard to the two males in the study, Subject 1, who received consistent oral motor home treatment, produced 10 individual phonemes in his babbling, one word approximation, and three true words. However, Subject 2, who did not receive consistent or frequent oral motor home treatment, produced 9 individual phonemes in his babbling, but had no word approximations or true words. It is important to note that there was an age difference between these two subjects that may account for the difference in their speech output. Subject 1 (i.e., 27 months) was 6 months older than Subject 2 (i.e., 21 months) at the time of the posttest. Subject 2 (i.e., 21 months) was closer in age to Subject 3 (i.e., 20 months). However, Subject 3 (female, consistent treatment) may have demonstrated more speech output including reduplicative babbling and many word approximations due to a gender difference.

With regard to the two females in the study, Subject 3 demonstrated reduplicative babbling and many word approximations, whereas Subject 4 exhibited one phoneme while babbling, three word approximations, and one

Table 4. Posttest Results: Battery for Oral-Motor Behavior in Children (Long, Bahr, & Kumin, 1998)

Assessment of Oral Movements During Feeding/Eating and Drinking				
Subject	Subject 1 (male, consistent treatment)	Subject 2 (male, inconsistent treatment)	Subject 3 (female, consistent treatment)	Subject 4 (female inconsistent treatment)
Age	27 months	21 months	20 months	23 months
Jaw Movement	0—Generally normal muscle function	1.88—Moderate muscle dysfunction	0.5—Generally normal muscle function	1.75—Moderate muscle dysfunction
Lip Movement	0.33—Generally normal muscle function	2.0—Moderate muscle dysfunction	0.33—Generally normal muscle function	2.0—Moderate muscle dysfunction
Tongue Movement	0.25—Generally normal muscle function	1.88—Moderate muscle dysfunction	0.25—Generally normal muscle function	1.75—Moderate muscle dysfunction
Total Score	0.19—Generally normal muscle function	1.92—Moderate muscle dysfunction	0.36—Generally normal muscle function	1.83—Moderate muscle dysfunction
Apraxia Inventory				
Subject	Subject 1 (male, consistent treatment)	Subject 2 (male, inconsistent treatment)	Subject 3 (female, consistent treatment)	Subject 4 (female inconsistent treatment)
Age	27 months	21 months	20 months	23 months
	0.5—Mild motor planning dysfunction	0.19—Generally normal motor planning	0.48—Mild motor planning dysfunction	0.54—Mild motor planning dysfunction

true word. It is interesting to note that Subject 4 (i.e., 23 months) was slightly older than Subject 3 (i.e., 20 months). Research has shown that reduplicative babbling (which Subject 3 exhibited) is an important indicator for future development of speech (Oller, Eilers, Neil, & Schwartz, 1999). The quantitative speech results from the small informal speech sample taken as part of this study seem to suggest that the children who received a consistent and fre-

quent oral motor home treatment program exhibited more advanced speech patterns such as reduplicative babbling.

It is also interesting to note that three of the four subjects (i.e., Subjects 1, 2, and 4) participated in at least 4 months of weekly speech-language treatment that included the use of oral motor treatment techniques. This would seem to indicate that the application of these techniques on a once per week basis did not

Table 5. Informal Speech Results

Subject	Subject 1 (male, consistent treatment)	Subject 2 (male, inconsistent treatment)	Subject 3 (female, consistent treatment)	Subject 4 (female inconsistent treatment)
Age	27 months	21 months	20 months	23 months
Productions	Babbling: the individual phonemes /m, b, p, d, t, k, ae, a, ou, and ʌ/ Word approximation: /dʌ/ for <i>door</i> Words: <i>poppop</i> , <i>Abby</i> , and <i>nitelite</i>	Babbling: the individual phonemes /m, w, b, p, d, k, z, a, and i/ Word approximations: none Words: none	Babbling: /aebaeaeae/, /aelaelae/, /baebabou/, and others. Word approximations: /hi/ for <i>hi</i> , /ʌb/ for <i>up</i> , /pe/ for <i>pray</i> , and many others. Words: none	Babbling: /mmm/ Word approximations: /mam/ for <i>mom</i> , /dae/ for <i>dad</i> , and /dɔ/ for <i>dog</i> . Word: <i>up</i>

affect eating, drinking, and speaking skill development as much as daily practice.

The subjects who received a consistent and frequent oral motor home treatment program exhibited generally normal muscle function, whereas the children who did not receive a consistent and frequent oral motor home treatment program exhibited moderate muscle dysfunction. These scores support the hypothesis that a consistent and frequent oral motor home treatment program helps to improve overall oral motor function in children with hypotonia.

The comprehensive oral motor home treatment protocol can be used in center-based or home-based early intervention programs. Parents can be initially trained in a single 2-hour training session with follow-up as needed to use the protocol at home. The demonstration videotape can be used by the parents to view models of the techniques. Information on treatment materials and techniques is readily

available. This is a cost-effective program, but it depends on strong commitment by parents to use the techniques consistently and frequently. A daily record sheet can be used to document the techniques used and to motivate the parents to use the techniques regularly. Follow-up by the speech-language pathologist is also important. The case studies demonstrate that improvement in oral motor skills, impacting positively on eating, drinking, and speaking can occur when the home treatment protocol is used consistently and frequently.

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Appendix

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PARENT QUESTIONNAIRE

(1) Which of the following oral motor techniques do you use with your child?

- _____ Oral massage with or without the NUK oral massage brush (Bahr, 2001)
- _____ Beckman Facilitation Techniques (Beckman, 1997) (See question 2.)
- _____ Therapeutic Feeding Techniques
- _____ Jaw Exercises (Bahr, 2001; Rosenfeld-Johnson, 1999)
- _____ Sara Rosenfeld-Johnson Hierarchy(ies) (Rosenfeld-Johnson, 1999)
- _____ Other

If there is another technique that you use with your child, please explain:

(2) Which of the following Beckman Facilitation Techniques (Beckman, 1997) do you use with your child?

- | | |
|--|--|
| _____ Upper lip stretch | _____ Gum massage |
| _____ Side-to-side upper lip stretch | _____ Upper cheek stretch |
| _____ Lower lip stretch | _____ Upper posterior cheek stretch |
| _____ Side-to-side lower lip stretch | _____ Lower cheek stretch |
| _____ Corner lip stretch | _____ Lower posterior cheek stretch |
| _____ Horizontal lip stretch | _____ Masseter cheek stretch |
| _____ Lip curl and stretch | _____ Probe for posterior cheek strength |
| _____ Resistive lip stretch | _____ Resistive chewing |
| _____ Probe for strength | _____ Lateral pressure to the tongue |
| _____ Diagonal nasal bridge stretch | _____ Pressure to inner-upper gum |
| _____ Z-stretch for the nasal bridge | _____ Pressure to inner-lower gum |
| _____ Mini "C" stretch | _____ Stimulation to midblade of tongue |
| _____ Pressure to the base of the tongue | _____ Palate and tongue blade sweep |
| _____ Stirrup for midblade elevation | _____ Inner lower gum sweep for tongue tip elevation |

- (3) How often do you use the Beckman Facilitation Techniques (Beckman, 1997) with your child? _____
- (4) What therapeutic feeding techniques do you or have you used?
- (5) Please include the approximate number of times per week that you do the following.
- _____ Oral massage with or without the use of the NUK oral massage brush (Bahr, 2001)
 - _____ Jaw Exercises (Bahr, 2001; Rosenfeld-Johnson, 1999)
 - _____ Horn Blowing Hierarchy (Rosenfeld-Johnson, 1999)
 - _____ Bubble Blowing Hierarchy (Rosenfeld-Johnson, 1999)
 - _____ Straw Drinking Hierarchy (Rosenfeld-Johnson, 1999)
- (6) At approximately what age did you begin using the oral massage/motor techniques with your child?
- (7) Please list any other oral motor techniques not previously mentioned that you use including the number of times per week they are performed.

Thank you for completing this questionnaire.