Case Study - Using The Listening Program

Editor's Note: The Down syndrome population historically have a high incidence of both speech and language problems. Children with Down tend to have narrow Eustachian tubes, which makes it difficult for middle ear fluid to drain. This combined with low muscle tone leads to frequent ear infections which often go undetected. As this affects the quality of auditory input the brain receives during early development, these children generally do not develop normal auditory processing. The Listening Program® can address this area.

This case study is being presented by the author at the World Down Syndrome Congress being held in Suntec, Singapore April 14-18, 2004.

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Name:	"M"
Gender:	Female
Chronological Age:	7 years
Clinical Diagnosis:	Down Syndrome
Reason for Referral:	M's parents had concerns for her regarding her communication, writing, and organizational skills, posture, academic performance, and behaviors.

BACKGROUND INFORMATION

M was a full term baby and delivery was normal except for jaundice after birth. M was born with a hole in her heart which was successfully operated on at 5 months of age. M began to roll over at 6 months, sit at 9 months, and walk at 18 months. She began to talk at 3 years and spoke in sentences by 4+ years.

M had difficulty with coordination and poor muscle tone. She was a quiet, passive baby but would often laugh or smile. She liked to be held but showed poor muscle tone. She would be easily frustrated, was sensitive to criticism, and had a short attention span. As she grew, M liked to play with jigsaw puzzles. She liked to sing and dance and enjoyed outdoor activities such as swinging and running.

M exhibited sound sensitivities and had difficulty focusing if there were other sounds in the environment. She was unable to understand most requests and did not react to them. She showed difficulty in producing rhythmic sound. As a result of being unable to process information, she often engaged in self-talk and avoided group play.

M showed many signs of tactile defensiveness. She was bothered by sand and anything messy, refused to wear hats, and had difficulty with fuzzy clothing, collar tags, and textures. She appeared to seek vestibular input. She liked fast movements, climbing high, and rocking. Overall M showed difficulty in sensory

modulation and processing, which was affecting her skills in various areas because of her brain's inability to cope with the information.

PRIOR TREATMENT

Initial treatment included a combination of sensory integration, neurodevelopmental techniques, and perceptual training using remedial activities. M was also given adaptations and compensation techniques for her fine motor activities.

Sensory Integration treatment was used to enhance her abilities in ideation and motor planning skills, and to reduce her sensory defensiveness. She showed good gains in areas of sensory defensiveness, motor control, and fine motor function. Integration of other approaches was used systematically to manage her posture and fine motor skills. Her home program was consistently drawn and executed with the help of a caregiver.

After a period of intervention, M continued to show weaknesses in motor efficiency, bilateral coordination, motor planning and sequencing skills, retrieval from memory, spatial organization, and articulation. Her response time was heavily compromised. She needed a lot of visual support and had difficulty managing complex tasks.

The above primary issues (relating to processing) continued to affect her functional abilities in writing and social communication, especially when she needed to maintain a conversation and in academic skills such as spelling and maths.

In her mainstream integration school, it was noticed that she avoided tasks with complexity and generally showed low energy levels during these task times. She was found to be defiant and at times refused to attend in a novel situation requiring mental manipulation and processing.

Existing occupational therapy, speech therapy, and tutoring intervention did not appear to impact her much needed sensory processing skills. It was felt M had reached a plateau in treatment with these conventional modalities and might need another program that could boost her sensory registration and processing skills.

The Listening Program® was chosen to provide additional input to the vestibular and cochlear systems to enhance the overall progress in various areas of her functioning.

GOALS FOR INTERVENTION

1. Postural control, balance, and bilateral motor skills in gross and fine motor areas.
2. Improved attention and organizational skills.
3. Improvement in motor planning, association, and sequential skills.
4. Improvement in mental manipulation in auditory/visual motor tasks, e.g. drawing and writing skills
5. Enhance ability to maintain a conversation up to 3-4 steps meaningfully.

PROGRAM IMPLEMENTATION

M began cycle one of The Listening Program in May 2002 with the Sensory Integration Classic 1 CD using a Sony CD player and Sennheiser 590 headphones. She complained that she did not like the music and did not want to wear the headphones. After discussion, we decided that we would try the TLP Original Kit, Extended Schedule of 15 minutes once per day, two weeks per CD for a total of sixteen weeks and began this program in June.

TLP CD 1:
M was able to sit and maintain her posture better during work time. She was attending better at home and in school. She showed slight improvement in clarity and ability to ask questions. Improvement was noted in her handwriting and was rated 4. She has been more flexible and attempts new tasks. M was able to persevere and stay on task for 10 minutes and this was new for her.

TLP CD 2:
M is showing more confidence in her ability to ask questions within the proper context. She is showing better sentence structure and her focus and organization continue to improve. M's parents noticed small gains in clarity of speech and that she appeared more responsible.

TLP CD 3:
Negative changes appeared when we changed to a Base Schedule of 15 minutes, twice a day. She was angrier, very sensitive, and moody. In the classroom she did not listen to her teachers and was very sensitive although she did do her work. Her focus was not good: she was active and disorganized. Her voice sounded different - softer, higher pitched, and words were not as clear.

We decided to continue the same schedule while increasing her sensory processing activities. We asked that she spend 30-45 minutes a day, three times a week on the playground. She began to gain in functions again and stayed more calm and relaxed. Her drawing skills appear to be better with visual support and she is showing more complexity by adding details to the picture. Spatial orientation appears to be emerging much better. Her parents rated her reading skills as above average this week.

TLP CD 4:
M maintained gains in posture, emotional stability and in spelling. A change noted after the introduction of CD 4 was improved vocabulary.

TLP CD 5:
During this time M gained in her ability to stay focused. Both her caregiver and her parents noticed that she appeared more thoughtful and responsible. Her parents graded her performance above average compared to previous weeks.

TLP CD 6:
More changes were seen in her vocabulary. Other motor changes were sustained.

TLP CD 7:
M is showing more self-confidence. Her parents have noticed that she is doing her math without struggling and it is easier for her.

TLP CD 8:
M is showing considerable change in self-organization, being more responsible, improved sentence structure, increased vocabulary, and her sequential skills moved

from three to four steps. Her parents noticed better sense of rhythm, better coordination, and more independence. Her sound sensitivities have decreased.

Following completion of a first cycle with the TLP Kit, M continued listening with Speech and Language Classic 1 and the High Spectrum CDs continuing listening for 15 minutes, twice a day for two weeks with each CD. During this time, M continues to show better skills with math, reading, and sequencing.

CONCURRENT TREATMENT

M was seen for 6-8 hours of occupational therapy in the clinic for postural facilitation, fine motor, and visual motor skills during this period. Her home program included Wilbarger Protocol, sensory motor activities, and sensory diet using body and mouth activities. She continued to receive speech and language intervention with a speech pathologist. In addition to regular schooling, M has a private tutor who works to strengthen her skills in various areas.

FOLLOW UP METHODS

1. During occupational therapy sessions
2. Through telephone conversations
3. The "Changes to Look For" form developed by ABT. This was modified to seek the parents and caregivers feedback via the internet or by fax on a weekly basis.

PRE/POST TESTING

Assessment Protocol

- The Sensory Profile: a caregiver questionnaire containing statements about the responses of children ages 3-10 to sensory events in their daily lives
- Structured Clinical Observations: including drawing, writing samples, and measures of postural control
- Motor Planning
- Communication
- Bilateral Coordination and Sequencing Skills: fine motor and language processing skills
- Test of Visual Perceptual Skills - Revised
- Teachers Assessment
- Occupational Therapy Handwriting Assessment

Test of Visual Perceptual Skills - R (TVPS, non-motor)

Pre TLP

Test Results	Raw Score	Visual Perc. Ages	Standard Score	Scaled Score	T Score	Percentile Rank	Stanine
VD	3	-	66	3	28	1	1

VM	0	-	55	1	20	1	1
VSR.	1	-	64	3	26	1	1
VFC	7	4-10	93	9	46	32	4
VSM	1	-	65	3	27	1	1
VFG	3	-	74	5	33	4	2
VC	2	-	70	4	30	2	1

The above results showed that M had difficulty in many areas since the perceptual ages in most of the areas could not be documented at all. She is a visual learner, which could be noted from the visual form constancy subtest in which she perfomed better than other areas and her visual perceptual age score could be obtained, i.e. 4-10 years. This particular subtest provides visual cues to match. Hence the processing demands are less compared to other areas in this test.

Post TLP

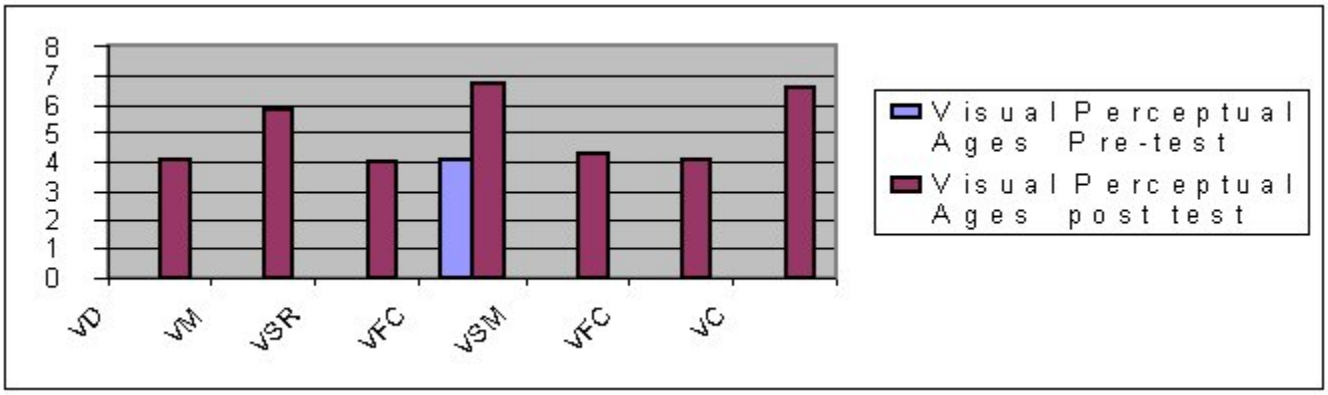
Test Results	Raw Score	Visual Perc. Ages	Standard Score	Scaled Score	T Score	Percentile Rank	Stanine
VD	5	4-1	76	5	34	5	2
VM	8	5.8	87	7	41	19	3
VSR.	2	< 4-0	56	1	21	1	1
VFC	9	6.7	98	10	49	45	5
VSM	3	4.3	70	4	30	2	1
VFG	5	4.1	79	6	36	8	5
VC	8	6.6	99	10	50	47	2

	PRE TLP	POST TLP
Sum of Scaled Scores	28	39
Visual Perceptual Age	N/A	6.7 years
Visual Perceptual Quotient	58	69
Percentile Rank	1	2

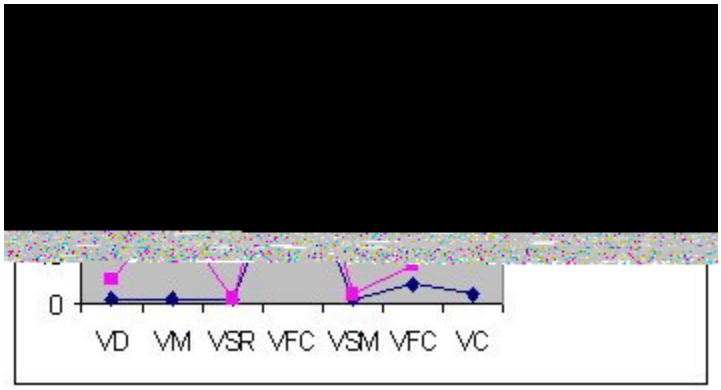
M showed positive change in visual memory and visual closure activities. She also made gains in visual sequential skills. Overall it was observed that scores improved in all areas. Her visual perceptual ages were recorded in only one area pre TLP due to poor raw scores while post TLP scores range from 4.1 to 6.7.

Pre-Post Therapy Results following The Listening Program Intervention

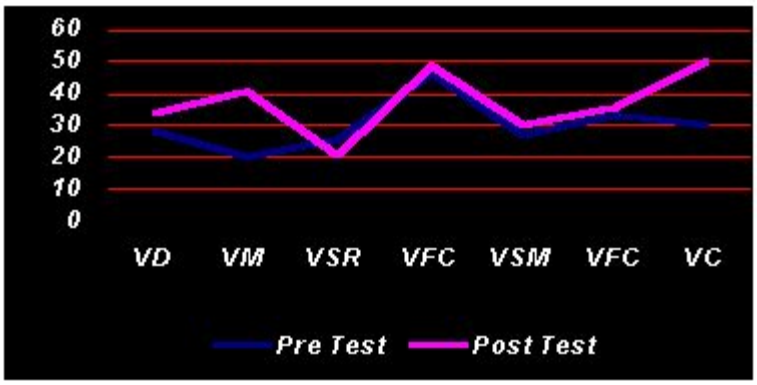
Visual Perceptual Ages in Pre-Post Test of Visual Perceptual Skills - Revised

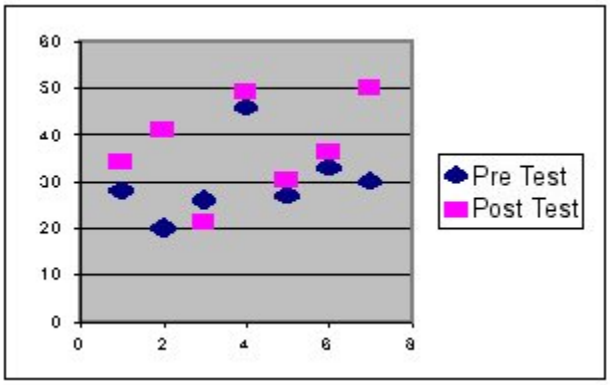


Percentile Rank in Pre-Post Test of Visual Perceptual Skills - Revised



'T' Scores in pre-Post Test of Visual Perceptual Skills - Revised





CONCLUSION FROM TVPS RESULTS

During M's pre-tests the developmental age in many areas could not be documented due to poor raw scores. However, after TLP, visual perceptual ages could be documented through raw scores in comparison to the norms. This shows she has made positive changes in most areas. Significant changes were seen in the areas of visual memory and visual closure tasks. These changes support the conclusion of improved sensory processing and retrieval skills in tasks that have visual cues. This suggests improvement in her awareness, ability to register, retrieve, and reproduce desired commands in a more organized fashion. Changes noted in visual closure areas support improved motor planning and sequencing.

OTHER RESULTS

In the area of gross motor skills, M is able to jump with two feet and shows better coordination. She is now able to hop with one leg in a single and sequential manner. She is able to make more coordinated jumping jack movements with auditory input. She is able to stand and pump in a swing with visual prompts. In the area of coordination and multi-sensory processing, M is now able to participate in an activity involving somato-sensory, vestibular, visual, and auditory input together with rhythm. This means she is able to coordinate actions involving legs and hands during a song with rhythm and beat. She was not able to do this previously and always had a hard time participating during song time in the classroom.

In the area of fine motor skills, M is now able to hold and use writing tools in a dynamic tripod grip. She shows much better control in handling tools such as

scissors without using any adaptations. Writing skills have improved largely in the area of fine motor control of the hand, spatial orientation, and copying skills. She is now able to copy in the classroom from the chalkboard. M has shown remarkable progress in her posture during TLP in sitting or during communication time. She can maintain an erect and attentive posture and this is still maintained post TLP.

As to her behavior, M has shown positive changes in her attending skills in individual and group sessions. She is able to stay organized and on task for 30-60 minutes depending on the task and the instructions. Previously her time limit was only 5-15 minutes and after having a break she did not return to the table. It was noted that after TLP she was able to return to her work at the table and could sustain her attention. During an occupational therapy session, a class at school, or events at home, she is able to attend to a new task with some help. Previously she would fuss or refuse to even try to do something new. She is now more flexible and perseveres with the task.

M shows more details in her drawings and parts are more proportionate. She now shows good spatial organization in her figures. She is able to follow simple copying skills with visual support involving spatial organization, details, and curves.

M is able to initiate and maintain a three-step conversation with better response time. She is able to respond to questions with a maximum of two prompts. Before TLP she would normally need five prompts. Her parents report that she now seems to think before acting and is able to connect the consequences.

M showed improvement in her vocabulary and spelling recall. She is able to read stories and answers questions. She initiates reading willingly and shows better sentence structure. She is coping much better with her math skills and is able to carry two digit additions with ease.

In regard to motor planning, M is able to work on a task with 3-4 steps, that is pre-structured. She is able to follow the color sequence and shape sequence activity with three to four variables, with or without visual guidance. In general, she shows less dependence on verbal prompts.

SUMMARY OF CHANGES

The Listening Program was a worthwhile experience for M. For the most part, the Extended Listening Schedule was well managed at home with her compliance. Based on pre and post testing and systematic observations in her underlying skills as well as functional skill, TLP appears to have had a positive impact. M showed a remarkable growth spurt in the complexity of her play, planning abilities, building associations, and memory recall for auditory processing and sequencing skills. Functional changes were observed in every category of her profile.

As previously mentioned, prior to TLP M had reached a plateau in her learning profile and required prompting and heavy visual support to function in different areas of her individual educational program. She is once again making gains in these areas. Since the implementation of TLP, changes have been obvious in her postural control and sequencing skills. Her listening program has made an impact in many areas including listening, communication, motor planning and bilateral integration, and sequencing. She also showed positive changes in the areas of fine motor and writing skills. These gains have positively influenced her lifestyle including sociability and behavior both

at home and in school. Her parents have reported that she no longer slouches and can sit in her chair at the table for a longer time. She is also more easily taught than before TLP.

Although M has also had lessons with a speech therapist and a tutor, gains with TLP occurred faster in areas of concern. She was not given any specific activities to improve her visual motor processing, yet there are noticeable changes in her visual perception and handwriting skills.

FOLLOW-UP RECOMMENDATIONS

Based on M's positive response to The Listening Program, it was anticipated that she would benefit from continued listening. However as research has shown that the results of listening continue even after the completion of The Listening Program, it was decided to give her a break for 8 weeks. She was able to maintain the progress made for one month. Following, there was a sharp decline in her behavior, performance, and listening skills.

A re-assessment was carried out using clinical observation and communication skills in a play situation in a sensory integration adaptive response clinical setting. Her performance and skills were reviewed with the teachers and therapist. Though some of the component skills in communication and motor planning were retained, her ability to handle novelty, her spatial orientation relationship, and her memory retrieval were affecting her learning and behavior.

It was decided to move her to the Condensed listening schedule of 30 minutes per day, 5 days per week at home in conjunction with her occupational therapy treatment. A gradual increase in her positive behaviors began to appear after that. Her behaviors related to social communication, listening skills, and learning have gotten better. Her attention skills in class have been improving and she is doing better in the classroom. Her ability to maintain a visual motor memory related task with three symbols is better. Her response time is delayed in novel situations whether it is a social communication or a three-dimensional concrete play environment. She is able to retain simple rules in play situations by manipulating the large objects in the sensory integration lab.

CONCLUSION

Continued use of The Listening Program has been useful to M in conjunction with her occupational therapy intervention. She has shown positive changes in Math and English. It has also been an effective tool combined with her home program. She has improved in many areas of her performance and behavior.

APPENDIX

Research Review
The Role of Vestibular and Auditory Senses in Enhancing Performance and Behaviour
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Many professional groups have investigated the role of vestibular function in motor skills, bilateral coordination, development of speech and language skills, memory, and much needed cognitive skills for academic success. Vestibular connections with

higher functioning areas, i.e. perception, language, cognition, and physiological functions, are now being recognized. Kantner, R.M. et al (1976) investigated and compared the effect of vestibular stimulation on motor performance in typical children and children with Down syndrome. They found a significant improvement in motor function following vestibular stimulation.

Auditory stimulation influences both the vestibular and cochlear systems due to anatomical and neuro-physiological factors. It has been observed that the vestibular system is highly diversified in its distribution and works as a navigator for human mind connectivity. Hence, it can influence both motor and cognitive areas in performance.

The work of Dr. Tomatis and of professionals from other disciplines has shown that the use of auditory intervention techniques to facilitate sensory processing, performance, learning, and behavior are warranted. Hence The Listening Program® comes as an ideal tool to use with Down syndrome children to address sensory processing skills at higher levels.

TABLE 1 Summary of Changes
1. Functional and developmental outcomes FRTG
2. Changes observed in underlying systems

Functional and Developmental Changes	Changes noted in Underlying Systems
Gross Motor Able to jump with two feet and shows better coordination. She is able to hop with one leg in a single and sequential manner. She is able to make more coordinated jumping jack movements with auditory input. She tries to make a stride jump for the first two-three steps. She is able to pump a swing while standing with a visual prompt. **Coordination - Multi-Sensory Processing** able to coordinate actions involving legs and hands with the song with rhythm and beat.	**Sensory Processing - Body Senses** Vestibular and Somatosensory Processing - Better vestibular processing could be directly seen through gains she has made in the areas of gross motor and fine motor skills. Vestibular processing is also closely linked with the bilateral activities in gross and fine-motor activities. **Sensory Processing** Body Senses in association with auditory and visual Processing - She has shown good change in overall sensory processing skills, which could be seen in the areas of communication, drawing and writing skills. **Multi-sensory Processing** She is able to participate and perform an activity involving somato-sensory, vestibular, visual and auditory input together with rhythm. This was never observed with her before. She always had a hard time participating during song time in the classroom.
Fine Motor/ Writing Skills Able to hold and use the writing tools in a dynamic tripod grip. Shows much better control in handling tools - scissors skills - without using any adaptations. Shows better in-hand manipulation with tools	**Posture** She showed remarkable progress in her posture while seated or during communication time. She could maintain an erect and attentive posture throughout the program and it is still sustained.

and objects. Writing skills have improved largely in the areas of fine motor control of hand, spatial orientation and copying skills. Able to copy in the classroom from the chalk board.	
Behaviour She has shown positive changes in her attending behaviours in individual and group sessions. Her fidgeting was not noticed in special school, however it was observed that at times she pinched other children in mainstream integrated school especially during multiple-step tasks when she could not organize the information. Work duration was much better in school as well as homes. It was noticed that she could recall and stay on the task for longer.	**Organization of Behaviour - Attention** She is able to stay organized and on task for 30- 60 minutes depending on the task and the right challenge. This time used to be only 5-15 minutes and it was reported that after having a break she did not come back to the table. However, it was noted that after TLP intervention, she was able to come back to work at the table and could sustain at her work site.
Drawing Skill She shows more details and parts are more proportionate. She shows good spatial organization in her figures.	**Reaction to Novelty** Attends a novel task during the occupational therapy session or at home or in school. She is able to attend to a novel task without fussing with some help instead of refusing to it completely. She is more flexible and perseveres in the task.
Communication Skills She is able to initiate and maintain a 3-step conversation with better response time. Her Pprents reported that she now seems to think before acting and is able to connect the sequences.	**Discriminative skills** She has shown improvement in tactile, visual, and auditory areas. Visual discrimination was observed in the Test of Visual Perceptual Skills (refer to table).
Drawing Able to follow simple copying skills with visual support involving spatial organization with details and curves.	**Response Time** She shows better response time. She is able to answer questions with a maximum of 2 prompts, this used to be 5 prompts.
Vocabulary/Reading Skills/Spelling Skills Marianne showed improvement in her vocabulary and spelling recall. She is able to read stories and answers questions with good recall. She initiates reading willingly and shows better sentence structure.	**Motor planning** Able to initiate by organizing the object in a place using 2-3 step tasks. Able to work on a task with 3-4 steps, when this is pre-structured. Able to follow the color sequence and shape sequence activity, a three- four variable choice situation with or without visual guidance. She shows less dependence on verbal prompts.
Maths She is able to cope much better with her maths skills. She is able to carry two digit additions with ease.	