Sensory integration as a foundation for learning: a case study

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May 2008

Note: This document describes a Capstone Dissemination project reflecting an individually planned experience conducted under faculty and site mentorship. The goal of the Capstone Experience is to provide occupational therapy doctoral students with unique experiences whereby they can demonstrate leadership and autonomous decision-making in preparation for enhanced future practice as occupational therapists. As such, the Capstone Dissemination is not formal research.
Abstract

Effective sensory integration provides the basis upon which children will develop academic learning and social behavior. During the sensory integration process, the brain integrates incoming information and assigns meaning by selecting what sensory input will be attended to. Humans need to effectively integrate sensory input in order to respond to situations with a purposeful and appropriate manner. This case study report describes occupational therapy sensory integration interventions for Adrian, an eight year old boy who has been participating in early intervention services since the age of three. He demonstrated limitation in the areas of sensory processing, sensory modulation, fine motor, visual motor, visual perception, body awareness, motor planning, postural control, and bilateral coordination.

Presently, increased research in the field of occupational therapy aims to prove the efficacy of sensory integration theory and intervention (Davies & Gavin, 2007; Miller, Coll, & Schoen, 2007; Schaff & Nightlinger, 2007). The present case study is unique in describing (a) a complicated and long standing history of occupational therapy sensory integration interventions for sensory processing dysfunction (b) involved medical and educational history (c) a focus on meaningful occupations that specifically address goals, and (d) additional observations of Adrian in school, home, and tennis practice environments. This case study adds to the credibility of the occupational therapy sensory integration interventions. Additionally, this study suggests the value of using occupational therapy sensory integration as the basis of learning, especially in regards to motor planning (praxis) in novel bilateral tasks.
Introduction

Diagnosis

Adrian is an eight year old boy who has been participating in early intervention services since the age of three. At the time of initial observation and evaluation in the fall of 2007, Adrian demonstrated limitation in the areas of sensory processing, sensory modulation, fine motor, visual motor, visual perception, body awareness, motor planning, postural control, and bilateral coordination. These terms will be defined with examples later in the case report.

Background Information

Adrian was born more than three months premature on June 13, 1999 weighing only 2 pounds, seven ounces. He was one of identical twins who suffered from twin-twin transfusion syndrome which led to early delivery. His younger twin was born weighing 14 ounces and died at the age of four months while still in the hospital. Adrian was required to remain in the neonatal intensive care unit of the hospital for two months prior to discharge due to medical instability. All developmental milestones were approximately three months delayed. Additionally, Adrian did not crawl and did not walk until he was 16 months old. Adrian also experienced difficulties with sleeping and in the area of dressing. His parents began to develop concerns when Adrian was two and a half to three years old in the areas of delayed language development, verbal expression, and low tolerance for sensory stimulation. Adrian often repeated back what he heard. His parents described him as, “A very sweet and happy child.” In September and October of 2002, Adrian attended a Montessori school for only 4-5 weeks due to his parents and teachers agreeing that the educational system was not meeting his needs. As a result of these concerns, Adrian’s parents decided to consult professionals at the Atlanta Speech
School, an educational setting with an occupational therapy clinic that specializes in language and learning delays, to determine if services were warranted.

Adrian’s initial occupational therapy evaluation was in November of 2002. At this time, he demonstrated difficulty attending to structured tasks and attempting unfamiliar activities. Adrian participated in occupational therapy from December 2002 until May of 2003. After making significant improvements, he discontinued therapy in May of 2003 but returned to therapy in January 2004 due to concerns in the areas of fine motor and visual motor skills. Adrian returned to occupational therapy from January 2004-May 2005 to address handwriting, fine motor control, visual motor integration, visual perception, bilateral integration/coordination, and sensory modulation. Finally Adrian reinitiated participation in occupational therapy in May of 2007 to the present at which time he is continues to work on these occupational performance skills.

With regards to formal education, Adrian was accepted into the three year-old preschool class in the Atlanta Speech School’s Stepping Stones Program starting in the fall of 2003 with the chronological age of four years. The Stepping Stones program was developed for children with language processing difficulties, with lead teachers having their certification as Speech Language Pathologists, and occupational therapists supplementing class programming. Adrian participated as a student in the program for two years, during which time he demonstrated improvements in both the classroom and the occupational therapy clinic setting. Unfortunately, his learning profile delays were too pronounced to continue his education in the Atlanta Speech School. In the months to follow, Adrian was accepted to the Howard School, which is a specialized school for students with combined language-learning disabilities. He has since
attended this school, where he began as a kindergartener. Finally, Adrian has been participating in extracurricular academic tutoring since the fall of 2005 to the present.

Adrian is a unique child amongst his family. Adrian’s mother is from Vietnam and is a retired attorney, while his father is a CEO and founder of a large corporate restructuring company. Adrian’s parents were both educated at Harvard University. Adrian’s two older sisters both attend a prominent private school in Atlanta that provided educational programming for gifted children who are interested in learning multiple foreign languages. His oldest sister is currently involved in a youth travel program for the United Nations. He also has a younger brother who is currently in preschool and is now learning his first foreign language. Adrian’s Grandmother attends every occupational therapy session instead of his mother. Since Adrian’s family is academically inclined, he has learned to adapt by playing video games. His grandmother once stated that he plays them almost every free moment of the day when he is not engaged in structured activities such as tennis.

**Model of Practice**

Dr. A. Jean Ayers first began to develop the theory of Sensory Integration in the 1950’s as she was the founder of the evaluation and intervention strategies. According to Sensory Integration and the Child (2005), this model of practice relates to the unconscious process of the brain which organizes information detected by the seven sensory systems which include: visual, auditory, tactile, olfactory, gustatory, proprioceptive, and vestibular system. The proprioceptive and vestibular sensory systems are not well known outside the realm of sensory integration. The vestibular system relays information related to the position of the head in relationship to gravity or movement. The role of the proprioceptive system is to alert the brain about the position of the
muscles and joints. For example, when a child hangs upside down from the monkey bars, the vestibular system provides the information that he or she is inverted. The proprioceptive system relays the information that the knees are flexed over the bar while the trunk is in an extended position.

The brain integrates incoming information and assigns meaning by selecting what sensory input will be attended to. During a class, for example, a student must listen to the teacher while ignoring competing noise in the hallway. Additionally, humans need to effectively integrate sensory input in order to respond to situations with a purposeful manner which is known as an adaptive response (Ayers, 2005). For instance, when climbing a flight of stairs a person must perceive the height of the steps and then integrate this information with the vestibular and proprioceptive systems in order to not to ascend the steps without falling. Finally, effective sensory integration provides the basis upon which children will develop academic learning and social behavior.

One type of poor coordination that is a result of sensory integrative dysfunction is a deficit in motor planning (praxis). This type of sensory processing problem is called developmental dyspraxia, or if it is fairly severe, apraxia. According to Ayers, developmental dyspraxia is one of the most common signs of sensory integrative dysfunction in children with learning disorders or other mild developmental delays (2005). The primary occupation to learn motor planning for children is through a variety of play styles.

At a young age an infant learns how to grasp a rattle and bring it to his or her mouth which requires accurate motor planning and proprioception of the upper extremity and mouth. At approximately two years of age, a child will develop motor planning through imitation such as playing “peek-a-boo” with an adult (Ayers). Near the age of four, a child is able to build
complex structures with legos and also copy designs involving constructional praxis (Case-Smith, 2005). Children also require praxis to master tasks such as pumping a swing, mastering a tennis swing, climbing, and opening their food. Children who experience difficulties with motor planning, such as Adrian, may find difficulties in dressing, novel tasks, and skipping along with many other areas (Case-Smith).

In order for a child to be successful at motor planning, he or she needs to have a good body percept or awareness. This involves having an awareness of how the body is designed and how each one of the body parts move. The size, weight, and the boundaries of all movements ever made all shape a child’s perception of how his or her body can move through the environment (Ayers). If a child has poor body awareness, he or she will experience difficulties with motor planning and consequently have inaccurate movement, such as falling or not being able to correctly hold a pencil.

Motor planning is built upon a foundation of integrated proprioceptive, tactile, and visual input. Typically children who have motor planning difficulties rely on vision more since they are receiving inaccurate proprioceptive and body awareness sensory input. Fortunately, body awareness typically is a subcortical process. Motor planning can involve subcortical or cortical processing. An example of subcortical motor planning is an avid figure skater not consciously thinking about how to stop, which is a relatively easy skill. On the contrary, cortical motor planning is the conscious process a skater completes to know how to move and where his or her body is in space while learning a difficult, novel jump. Therefore, motor planning is a higher level function because it requires a foundation of accurate integration of many different sensory systems in order to have success, especially in novel tasks.
Scientific Evidence for the Model of Practice

Jean Ayers Sensory Integration (SI) theory is highly researched especially in the area of praxis, yet still manages to generate immense controversy in the field of occupational therapy (OT). Over the past 35 years, there have been many research studies on the effectiveness of occupational therapy sensory integration treatment methods. Unfortunately, some studies say that SI is not effective (Vargas & Camilli, 1999), while others state that interventions based upon these theoretical principals are effective in the treatment of children with sensory processing disorders (SPD) (Hoehn & Baumeister, 1994). Therefore, no consensus exists within the professional community regarding the efficacy of SI in OT. This debate has heightened awareness as to the need for more precise methods to research the theory behind sensory integration (Hinojosa, 2007; Davies & Gavin, 2007).

Presently, more scientific ways to prove the efficacy of occupational therapy sensory integration theory and intervention are underway. In a recent study completed by Davies and Gavin (2007), electroencephalography was used to compare the brains of children with SPD compared to typically developing children. This study examined the assumption that there is a relationship between the brain and behaviors that are typically linked with children who exhibit SPD. The results of the study revealed there are differences in brains of children with SPD because typically they are hyperresponsive or hyporesponsive to auditory stimuli, when compared to typical children. Although this study only examined auditory input, it is progress in supporting sensory integrative dysfunction as an accurate diagnosis and brings more credibility to SI theory.

A recent case study by Schaff and Nightlinger revealed the effects of OT SI interventions over the course of ten months on the behaviors of children who have poor sensory processing
The study completed retrospective chart review of evaluation data and analysis of parent interview data. Results revealed that many of the participants presented with problems that could be related to sensory avoidance and hypersensitivity to sensation. Based on assessment data, goals were developed and reviewed with the child’s mother to assure the goals were meeting areas of concern. A parent interview was conducted during the final month of intervention to obtain input about the child’s progress and to determine the success of the OT-SI program. Significant improvements were noted on goal attainment scales and improvements in behavior. Parent interviews revealed progress in the child’s ability to participate in home, school, and family activity. Although the results cannot be generalized to every child with sensory processing dysfunction, the study added credibility to OT-SI intervention.

A recent study by Miller, Coll, and Schoen (2007) used a pilot randomized controlled trial to reveal the effectiveness of sensory integration intervention methods utilized by occupational therapists to help children diagnosed with sensory modulation disorders (SMD). The children were assigned to one of three groups that consisted of OT-SI treatment, activity protocol, and no treatment. The results of the study revealed that the children who participated in the sensory integration intervention with an occupational therapist made significant progress towards their goals, attention subtest, and on a parent rating scale. Since randomized controlled trials are the gold standard of research, this study adds credibility to the efficacy of OT sensory integration intervention with children who are experiencing deficits as a result of SMD. In the future, further studies need to support the efficacy of SI in the treatment of sensory processing dysfunction in the areas of bilateral coordination, visual perception, and motor planning (praxis).

**Rationale for this MOP with this Case**
Impairments in the areas of sensory modulation, fine motor, visual motor, visual perception, body awareness, motor planning, postural control, and bilateral coordination were characteristic of Adrian at the beginning of the case study. These problems can be successfully impacted through the use of OT sensory integration intervention methods. Although, Adrian has participated in OT sensory integration intervention multiple times, he has consistently demonstrated improvements with each course of therapy. Consistently he returns to therapy due to the developmental delays related to sensory dysfunction. Ultimately, Adrian successfully achieves progress towards his goals.

**Uniqueness of the Case**

Adrian has a very unique medical history in that he was born very premature and survived twin-twin transfusion. He has been delayed in achieving developmental milestones, with significant delays in language processing and learning. Adrian is a classic example of a child who displays motor planning or praxis difficulties. Once he becomes familiar with an occupation such as tennis or baseball, he is proficient. When he encounters a novel motor challenge however, especially those that require bilateral integration, he fails. Adrian displays oral and tactile defensiveness. He lacks postural stability in both his upper and lower body and subsequently fixates by leaning on tables or propping his elbows against his body.

**Evaluation: Resumption of Occupational Therapy Sensory Integration Treatment**

At Adrian’s last psychological and learning assessment on April 17, 2007, he was given a full scale IQ score of 80 which was in the 9th percentile. At the end of testing, Adrian was diagnosed with Mixed Receptive-Expressive Language Disorder and Attention-Deficit/
Hyperactivity Disorder, Combined Type. As a result of these findings, Adrian’s parents are planning to implement OT sensory integration intervention in lieu of medication to address deficits associated with these disorders.

**Clinical Observations**

When participating in therapy, Adrian was observed performing a variety of occupations in order to make observations through an informal clinical assessment called Clinical Observations by A. Jean Ayers, which was modified by the Atlanta Speech School (Fischer, Murray, & Bundy, 1991). A copy of the informal evaluation can be seen in Appendix A. After observations, the following conclusions were made:

*Regulation/Sensory Modulation*

- Modulation is the nervous system’s process of self organization by certain parts of the brain releasing facilitatory messages to encourage more sensory input, or inhibitory messages to decrease the amount of activity. This process is similar to turning the volume on a radio up or down.

- Observation of Adrian in regards to modulation:
  1. Adrian had poor modulation when in an overstimulating environment.
  2. He has poor oral motor awareness and cannot chew gum. Additionally, he also chews inappropriate foods such as yogurt.
  3. Adrian bites his fingernails, perhaps due to anxiety or worries.
  4. Difficulties with interpersonal skills were noted such as the inability to sustain eye contact, interrupting others when speaking, and forgetting to ask for permission.
  5. Adrian made steady clicking noises with mouth while performing writing tasks.
Fine Motor/Visual Motor/Visual Perception

- Visual perception is the brain’s ability to correctly interpret the visual input from what the eyes are seeing. There can be many problems that are related to visual perception such as visual discrimination and closure.

- Visual motor is the type of sensory integration that is necessary to incorporate visual input to effectively control motor movements. For example, copying a picture is a visual motor challenge because the brain must visually perceive a design, organize it, assign meaning, and the send the correct neural output to control muscles (Case-Smith).

- Observation of Adrian in regards to fine motor, visual perception, and visual motor skills:
  1. Adrian is right handed and uses a tripod grasp when writing.
  2. He is beginning to know cursive lower case “c” and other lower case letters such as “p,” “g,” “j,” and “q.”
  3. Finally, poor in-hand manipulation and thumb use were noted.

Body Awareness/Motor Planning (Praxis):

- Body awareness is the perception a person has of his or her own body. Each person must have a mental “map” of how each part of the body moves in order to have controlled and accurate movements. For example, a child that is not aware of his or her legs would have difficulties playing a jumping game, such as hopscotch successfully. (Ayers)

- Motor planning is the ability to perceive, sequence, and perform novel body motions (i.e. completing a new suspended obstacle course).

- Observation of Adrian in regards to body awareness and motor planning:
1. Adrian experienced difficulties with motor planning and body awareness in novel tasks.

*Postural Control/Stability*

- Postural Control (Stability) is strongly influenced by the vestibular system to ensure a variety of movements such as a smooth swing of a golf club, or sitting in a chair at school. Finally, this system also gives protective equilibrium responses which are demonstrated when a person reaches out with a hand when falling down.

- Observation of Adrian in regards to postural control and stability:
  1. Poor head, neck, and trunk disassociation were noted. Adrian tends to turn and move as a unit, instead of segmental movements of his body.

*Bilateral Coordination*

- Bilateral coordination (integration) is the brain’s ability to integrate sensory information from both sides of the body. This process allows humans to distinguish left and right and participate in activities that involve both hands and/or feet.

- Observation of Adrian in regards to bilateral coordination:
  1. He is able to gallop with limited arm movements.
  2. He is not able to skip.

*Sensory Processing Measure*

Adrian’s family and school staff were given the Sensory Processing Measure (Kuhaneck, Henry, & Glennon, 2007) in the beginning of February, 2008. Unfortunately, non-compliance
was a large problem with administering this evaluation. Initially, Adrian’s grandmother and mother refused to fill out the “Home” form. After questioning, the grandmother replied that she was feeling so optimistic about Adrian’s improvements that she could not re-live the “bad days.” His mother was reported to have echoed the same feeling as the grandmother. The “main classroom” and “art classroom” forms, along with the “recess” form, were hand-delivered to Adrian’s teachers, but were not completed. The “music classroom” form was returned, with a total score of 33, with the max cut off value of 29, which indicates that Adrian is experiencing more problems than is considered “typical” in the environment. The “physical education” form was completed with a non-significant score. The teacher noted that Adrian has good physical skills, however directions are often not followed, and he frequently experiences conflicts with peers. The “bus” and “cafeteria” forms were not given since they are not applicable to Adrian’s school.

Bruinincks-Oseretsky Test of Motor Proficiency (Bruinincks, 1978)

*Complete Battery Test Scores:*

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<tr>
<td>Subtest:</td>
<td>Standard Score</td>
<td>Percentile Score</td>
<td>Description of Performance:</td>
<td>Stanine</td>
</tr>
<tr>
<td>1. Running Speed and Agility</td>
<td>29</td>
<td></td>
<td>Very High</td>
<td></td>
</tr>
<tr>
<td>2. Balance</td>
<td>29</td>
<td></td>
<td>Very High</td>
<td></td>
</tr>
<tr>
<td>3. Bilateral Coordination</td>
<td>9</td>
<td></td>
<td>Below Average</td>
<td></td>
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<tr>
<td>4. Strength</td>
<td>12</td>
<td></td>
<td>Low Average</td>
<td></td>
</tr>
<tr>
<td><strong>Gross Motor Composite Score</strong></td>
<td>79</td>
<td>93</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>5. Upper-Limb Coordination</td>
<td>18</td>
<td></td>
<td>Average</td>
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<table>
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<tr>
<th>Fine Motor Subtests:</th>
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<tr>
<td>6. Response Speed</td>
<td>9</td>
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When testing was completed, Adrian scored in the 51st percentile. After observing Adrian over the course of multiple treatment sessions, this evaluation represents his abilities. His strengths lie in his balance, speed, and agility, which he uses in tennis and baseball where he is talented. Adrian struggles in novel bilateral tasks, and also spatial relations in visual-motor tasks, such as playing the three-dimensional shape matching game, “Perfection.” Adrian is weak in his proximal trunk and upper extremities as demonstrated by the strength subtest and the difficulty he experiences in the clinic trying to maintain stability while flexing his elbows and elevating his legs while going down the “zip line.”


Adrian was evaluated using the Motor-Free Visual Perception Test. The results revealed that he was in the first percentile, with the age equivalency of five years, two months. Adrian was most successful with visual discrimination, form constancy, and visual short term memory, which happen to be the first three subtests. Adrian nearly failed the entire visual closure subtest. These results are not surprising, given his reduced attention and hyperactivity. This might explain why Adrian performed relatively better on the first three tests. In order to be successful at visual closure, a child must envision “drawing lines” in his/her head to complete the design. This requires higher levels of attention, in which was lacking, as demonstrated by using his feet
to bounce on a chair despite repeated requests by the therapist. Interestingly, Adrian sought out the most movement when the test was hardest for him. The results of this test provided yet further evidence to share regarding the importance of hyperactivity with their child.

**Occupational Therapy Goals**

The client was scheduled to participate in occupational therapy two times a week for one hour sessions to address the following goals.

1. Continue to provide family with sensory activities that will be developmentally beneficial for Adrian at home until discharge from the case study.

   **Justification:** Adrian spent most of his unstructured free time on school nights and weekends playing videogames and watching television. Presently, Adrian needs to be doing occupations that involve playing games, climbing, swinging, jumping and running to learn how to integrate these forms of sensory input. By limiting television and videogames, Adrian will ideally perform more physical activities that might benefit his development.

2. Adrian will be able to tolerate varied textures in his mouth for 30 seconds without showing signs of distress (i.e. making faces, excessive salivating, and complaints) by the time of discharge from the case study.

   **Justification:** Adrian nearly vomits when there is a texture that not “familiar” to him in his mouth. Chewing gum also could be a self modulating occupation for him compared to biting his finger nails.
3. Adrian will be able to spontaneously greet another child in therapy, without needing to practice a “script” with therapist before by the time he is discharged from the case study.

   **Justification:** Adrian needs to improve on initiating basic conversations without prompting from adults. An older male child from therapy was chosen since Adrian is in the gym every week with him.

4. Adrian will be able to successfully play the visual motor game “Perfection” with minimal assist from therapist within 90 seconds by the time he is discharged from the case study.

   **Justification:** Adrian struggles with 3D visual spatial challenges. This game’s small pieces also work on in-hand manipulation when turning the pieces and also visual scanning to figure where they match.

5. Adrian will be able to successfully participate in a game of hopscotch using sidewalk chalk with minimal assist from therapist by the time he is discharged from the case study.

   **Justification:** This activity will be a challenge for Adrian since copying a large design is a visual motor challenge for him. Additionally, drawing with sidewalk chalk is a strengthening exercise for the shoulder and gets his fingers “messy” at the same time. Adrian will have to sequence and break down the task in order for him to complete the occupation successfully. Hopscotch will challenge his motor planning abilities and also work on static/dynamic balance. Finally, the game is also a bilateral coordination challenge which is one of his largest deficits.

6. Adrian will be able to write lower case “c,” “a,” and “d” in cursive independently by the time of discharge from the case study.
Justification: Adrian requires a large amount of repetition in order to learn handwriting. By learning “c” first he will be able to transfer the motor pattern to other lower case letters with the same pattern.

7. Adrian will be able to successfully participate in a suspended obstacle course with minimal assist from the therapist by the time of discharge.

   Justification: Ideally, this goal will help with motor planning in a novel task. It will also work on timing and sequencing when going to/from each suspended device with the aid of a trapeze bar. Additionally, completing a suspended obstacle course is a strengthening exercise for core and arm muscles.

8. Adrian will be able skip independently without the need for demonstration by the end of the case study.

   Justification: This goal will encourage more integration of bilateral coordination tasks that are developmentally and age appropriate. Since Adrian did not crawl much as a child, bilateral coordination tasks will be challenging for him and are important to work on (Ayers).

Interventions and Outcomes

Goal 1. Continue to provide family with sensory activities that will be developmentally beneficial for Adrian at home until discharge from the case study.

   Interventions and Outcome: Due to concerned reports of the grandmother of extreme videogame and television time, an article from the American Academy of Pediatrics, a gold standard for pediatric recommendations, was given to Adrian’s mother. The article concluded
that screen time (television, movie, and video games) had detrimental implications for school work if not limited (Sharif & Sargent, 2006). The Academy’s recommendation is that parents limit weekday television and videogame time to less than or equal to one hour. Adrian’s mother took offense to the article being brought home by the grandmother. Unfortunately, since she does not attend therapy there was no other way to discuss the article with her except through email. Another intervention used to encourage more home sensory activities was OT homework. It was completed about 80% of time due to the grandmother’s influence. Undoubtedly, there is some family and cultural issues affecting this issue since the mother is originally for Vietnam. Overall, little improvement was made in this goal.

**Goal 2:** Adrian will be able to tolerate varied textures in his mouth for 30 seconds without showing signs of distress (i.e. making faces, excessive salivating, and complaints) by the time of discharge from the case study.

**Interventions and Outcome:** In nearly every therapy session Adrian was given a piece of gum. Gradually over the case study, he was able to tolerate the gum for one minute in the therapy clinic. Classroom observations revealed the biggest improvement, but will be discussed later in the paper. After Adrian practiced spitting the gum out of his mouth, he was able to chew longer, possibly due to knowing what action to take when it was not tolerable. Additionally, it was beneficial to teach Adrian how to remove disliked foods in order to prevent choking. Overall, Adrian was able to meet this goal.

**Goal 3:** Adrian will be able to spontaneously greet another child in therapy, without needing to practice a “script” with therapist before by the time he is discharged from the case study.
Outcome: Unfortunately, Adrian has not improved in this area. Despite working on the greeting every week, Adrian still needed to be prompted to greet therapists and clients who are in his immediate area. Typically while playing in the gym he will say to the therapist, “That boy is on the zip line that I want to play on.” Reminders are needed to say a greeting and also ask for permission to share games. Finally, Adrian has a habit of slowly “sneaking” away during conversations that involve eye contact.

Goal 4: Adrian will be able to successfully play the visual motor game “Perfection” with minimal assist from therapist within 90 seconds by the time he is discharged from the case study.

Outcome: A variety of visual perceptual interventions were used such as assembling model planes and sequential drawings which break down pictures into small steps to gradually get to the finished picture. Additionally, various board games were played such as Kerplunk and dominoes. Overall, improvement was made, but the goal was not met. At the beginning of the case study, Adrian required four and a half minutes with max assist from the therapist to complete Perfection. Towards the end of the case study Adrian completed the task in 75 seconds with min assist from the therapist.

Goal 5: Adrian will be able to successfully participate in a game of hopscotch using sidewalk chalk with minimal assist from therapist by the time he is discharged from the case study.

Outcomes: Fake snow, putty, finger painting, and sidewalk were a few of the interventions used to meet tactile portion of this goal. He responded the worst, which also happened be the first intervention, to the fake snow. It involved putting a fine textured silicone product in his palm and then adding water to make it grow. It completely repulsed Adrian, and
he only attempted the activity due to the grandmother’s request. By the time of completion Adrian was no longer bothered with getting “messy” when occupations are meaningful as demonstrated by the following “Making cookies” occupational analysis.

In regards to the strengthening, Adrian completed a variety of interventions such as hanging by his hands from a zip line with his lower body in flexion and also completing heavy work such as moving mats to “help” the therapist. By the end of the case study, Adrian could keep his lower body in flexion the entire length of the zip line (approximately 20 feet) which was not possible at the beginning.

In regard to the visual perception, Adrian got progressively better with his visual perception while he was copying the hopscotch game. He was able to break down the gestalt towards the end of the case study and as a result, his hopscotch board looked similar to the model. One intervention which might have been helpful by giving him strategies to break down a complicated design was the sequential drawings which were described earlier.

Adrian worked on a variety of bilateral coordination and motor planning interventions such as using a rock climbing wall, propelling a platform swing while “snowboarding,” crab walking, bear walking, and different hopping/skipping games. Adrian also used interventions such as a balance beam with “killer ants” underneath and one leg standing competitions where he challenged the therapist. Adrian did make some improvements such as coordinating the proper weight shift to propel a platform swing. Additionally, his balance did improve as demonstrated by genuinely beating the therapist in hopscotch and the one leg standing competitions. Unfortunately, his bilateral coordination did not improve in novel tasks, as demonstrated by the low scores in the bilateral coordination section of the Bruininks evaluation.
Goal 6: Adrian will be able to write lower case “c,” “a,” and “d” in cursive independently by the time of discharge from the case study.

Outcomes: Adrian learned handwriting in a variety of occupational forms. Writing outside with sidewalk chalk, a vertical dry erase board, and horizontal chalk boards were all used to give him different feedback and to help maintain attention. At the beginning of the case study, Adrian was progressing steadily with his lowercase cursive letters such as “c”, “a”, and “d”. Several weeks in, Adrian suddenly forgot the motor plans for the letters he learned. The rest of the case study required a review of the letter “c” and “a”. A clock made out of a plastic lid was made so Adrian could have a visual reminder to start and stop his “c” at one and five o’clock. By the end of the case study, Adrian had mastered his lower case cursive “c” and “a” once again.

Goal 7: Adrian will be able to successfully participate in a suspended obstacle course with minimal assist from the therapist by the time of discharge.

Outcome: In order to keep Adrian learning new motor planning, a variety of approximately six different swings were switched in and out. Additionally, the “rules” to the game such as not touching the floor or completing the course in the opposite direction kept the game exciting. Changing the theme of the obstacle course to “pirate ship” or “soldier boot camp” were used to keep his attention on the obstacle course. By the end of the case study, Adrian did improve in some areas. He was able to demonstrate mastery over new motor planning on the obstacle course after two attempts compared to three or four trials at the beginning of the case study. Unfortunately, when new swings were put up, Adrian could not think of the initial motor plan and required the therapist to tell him exactly how to complete the course.
Goal 8: Adrian will be able skip independently without the need for demonstration by the end of the case study.

**Outcome:** Despite all of the bilateral coordination interventions discussed earlier in the case study, Adrian was not able to master skipping without a demonstration beforehand. It was difficult for him to distinguish skipping from galloping. He can now gallop with either leg leading which is one step closer to skipping.

**Outside Therapy Interventions**

*Classroom Observation:* After visiting Adrian’s school, his behavior seemed to be consistent between therapy and the classroom. During circle time in the beginning of the day, Adrian “zoned out” from all of the talking completed by his teacher and a classmate describing the calendar of events for the day. Instead of sitting still on the floor, he was constantly shifting his position while staring around the classroom. While sitting in his chair during class time, Adrian repeatedly brought his feet up onto the chair and bounced. The teacher reported that this behavior was a problem in the beginning of the year, but it resolved after using a ball chair. After the need for movement was pointed out, the teacher agreed to use the ball chair again for classroom work.

Between lessons, the teacher passed out a basket of gum to allow each child to select a piece of gum. Typically, Adrian does not take a piece, but since the therapist was there, he requested to have a piece of “Speech School” gum. The teacher, being completely shocked, allowed Adrian to voice his preference for sweet bubble gum instead of the “spicy” classroom gum. Once the gum was in his mouth, Adrian was able to tolerate chewing for eight minutes.
Adrian also enjoys reading books while the story was read to him via a cassette tape.

Adrian tends to have similar behaviors at occupational therapy. When giving him purely oral directions, he “zones” out which is consistent with his receptive language processing delay. When giving directions for the obstacle course, Adrian understands what he needs to do only if the therapist is touching what apparatus she is referring to. This appears to be similar to the school books in that Adrian is most successful with auditory input when a visual is present. Adrian also has problems sitting still in therapy, and responds best to ball chairs. Unfortunately, special seating accommodations cannot be made when performing standardized assessments. Likewise, Adrian barely is able to tolerate gum in therapy if he does not immediately perform an activity. Since Adrian enjoyed the math activity, plus observing his friends chewing gum might have been the successful combination to chew his gum for eight minutes.

**Occupational Analysis of Treatment Session**

**Occupational Form**

For the occupation of “making cookies,” the important occupational forms were a table, bowl, cookie sheet, metal fork, large plastic spoon, and the ingredients. The smaller wet ingredients bowl was located directly in front of Adrian at a comfortable stirring distance away from his body. The larger dry ingredients bowl was located to the right of Adrian, and about two feet away from the edge of the table where he was standing. The cookie sheet was placed in front of Adrian’s left side. The measuring spoons and cups typically rested on the cookie sheet. The bag of chocolate chips with the directions on the back usually was placed in front of the student therapist. The unopened ingredients and supplies (brown sugar, white sugar, soda, flour,
salt, vanilla, eggs, and aluminum foil) were located beyond the wet ingredients bowl and cookie sheet, approximately two feet from the client. Adrian was standing in the middle of the long side of a rectangular table with the supervising therapist immediately to his left and the student therapist immediately at his right. His grandmother was at the short left side of the table. Everyone was seated on metal and plastic school chairs except for Adrian who preferred to stand. The occupation took place in a multipurpose room that served as an office, meeting room, and pediatric resource library.

**Occupational Performance**

Before making cookies, Adrian washed his hands and wiped down the table. He also rolled up his shirt sleeves and examined all of the ingredients. Next, Adrian picked up the bag of chocolate chips and proceeded to read the instructions for the wet ingredients. (Throughout the whole occupation Adrian consulted the bag for directions.) He carefully opened the packaging for all of the wet ingredients and after asking for proper measuring technique from the therapist, he carefully measured over a cookie tray to catch spills. Each ingredient was delicately added to the bowl, except for the eggs. Adrian insisted he did not need help breaking the eggs. He was successful on the first attempt, but on the second, he shattered the egg on the rim on the bowl. He then picked out the egg shells, and added a third egg successfully since the second egg landed on the floor and table. He then proceeded to stir the wet ingredients together and then pushed the bowl away from him on the table.

He then grabbed another bowl and opened all of the packages for the dry ingredients. He carefully measured the dry ingredients over the cookie sheet using his finger to level off the top of the measuring spoons and cups. After all of the dry ingredients were in the bowl, he stirred
using a metal fork. The wet ingredients were then added to the dry ingredients and then stirred using a long plastic spoon. Adrian then attempted to open the bag of chocolate chips, but could not since his fingers were so slimy. After cutting open the bag with a pair of scissors, he measured the chocolate chips, despite the fact of knowing the whole bag went into the bowl. Adrian then stirred everything together, and then smelled the dough by bending over and nearly sticking his nose in the mixture.

Next, Adrian intently listened while the therapist gave instructions on how to scoop the cookie batter. He then took a spoon in his right hand, and then pushed off the cookie dough using his left hand. Adrian then started making balls of dough, but had trouble making them uniform size. Additionally, dots had to be placed on the tray by the therapist to help with proper spacing for the cookies. While Adrian was laying out the cookie dough, he was fixating his legs in a crossed position to maintain stability. After filling up two cookie sheets, Adrian accidentally sneezed directly into the cookie dough bowl. The therapist then instructed him to sneeze into his elbow which he then excitedly practiced. Finally, Adrian washed his hands to remove the cookie dough, and then helped his grandmother put saran wrap over the cookie trays to take them home to bake.

*Meaning and Purpose Inferred*

Adrian realized the importance of measuring and following directions to ensure a finished product will turn out as it is intended to. Additionally, he learned that he can tolerate “sticky, messy things” on his fingers since it was his first time making cookies. Finally, Adrian enjoyed the smell of the cookies since he was able to pick the flavor which was his favorite. Finally, he enjoyed the occupation so much that he repeatedly gave the therapist “side hugs” and did not
stop waving good-bye to the therapist until the car drove away and was out of sight. At the next session, Adrian reported that the cookies were, “So so good,” and enjoyed eating them and sharing them with this family.

**Impacts**

The client had the initial impact of wiping the table down to ensure cleanliness. The impacted his occupational form by opening all of the packaging, measuring ingredients, mixing them together, and then scooping dough balls onto the cookie sheet. While making the cookies Adrian dirtied all of the bowls, forks, spoons, and measuring devices which he assisted to clean after the occupation was over.

**Assessment**

Initially, Adrian did not fully understand the significance of the directions and what would happen if they were not followed. Fortunately, he comprehended the concept and measured meticulously there after. Adrian also would rush to do tasks that he had minimal experience completing such as breaking eggs. Even though Adrian “accidentally” broke the first egg correctly, he was very willing to take suggestions for the third egg after the mistake with the second. Finally, Adrian responded wonderfully to his messy fingers as demonstrated by no complaints or signs of distress. In previous experiences, Adrian did not enjoy getting his fingers dirty so this occupation was a huge success in that regards. Most likely, since the occupation was so meaningful to him, it probably helped him ignore his messy fingers.

**Adaptations**
Adrian learned practical cooking skills such measuring and frequently consulting directions. Additionally, he learned specific strategies to successfully crack an egg and space cookie on baking sheets. Finally, he was able to realize that some messy things are enjoyable to touch.

Compensation

Since Adrian did not have the spatial awareness and attention span to properly space the cookies, the therapist utilized a form of compensation by putting “dots” on the sheet with cookie dough to encourage proper placement.

Re-synthesis

The therapist planned on “messy” occupations such as repotting plants, making clay pots, and also using a recipe to make play dough. Hopefully, Adrian would be immediately willing to using a recipe and remember measuring techniques in order to successfully make play dough.

Follow-up Interactions with Adrian

Home visit

Upon arrival at the home for a brief visit, Adrian immediately wanted to “rock climb” down a path to show the therapist his creek. He reported that he loved to throw rocks in the water, which is similar to activities he seeks out in other settings. He then hurried to his swing set in order to play “obstacle course” as in the clinic. Blowing wind and biting sea creatures were quickly imagined to be apart of the game. He then quickly went to the swimming pool where he proudly displayed his basketball hoop and reported that he was very good at the game.
and most likely better than the therapist. Next, Adrian sprinted to the elevator, and told the therapist the order of closing the doors and pushing buttons. Once on the third floor, Adrian would not stop, despite his grandmother’s request, to show the therapist his room. He was intent to play Wii videogames, which was his favorite activity at home. The game selected was a visual discrimination game where players have to match two faces as they were moving around a screen. Adrian was able to match the faces in 5 seconds before the therapist could even process what she was looking at. Amazingly, he was consistently correct with unimaginable speeds. At the request of his grandmother to go down stairs, Adrian reluctantly went, only inspired to show the therapist the hiding spots of his Gameboy, then to attend tennis lessons.

_Tennis Lessons_

Adrian participated in a tennis lesson with three other boys who were approximately eight to nine years old. They were required to participate in various drills where they had to make hits on different locations on the court. Repeatedly, Adrian made one successful hit after another. Compared with the other boys, Adrian had the best tennis technique without question. While watching his impressive abilities, his grandmother reported about his first official tennis match. During this match, Adrian was frustrated because he did not understand the scoring system. Additionally, Adrian did not display good sportsmanship at all times, and as a result his opponent cried. Consequently, the opponent’s mother ended the game. Meanwhile, Adrian had no idea that he was doing anything wrong, as he is naturally more aggressive in physical activities. Therefore, during the tennis practice, he was going to have scoring re-emphasized. It was amazing to see Adrian’s skills in sports, compared to how he struggles with novel tasks when presented in the clinic. Before leaving the tennis match, the student therapist was asked
difficult questions such as how Adrian was affected by the absence of his parents at therapy. In response, she stated that a child merely wants the love, attention, and support of his parents. When an evaluation report gets send home via the grandmother, the parents tend to get a negative slant by only focusing on the things that need to be improved on. If the parents were to come into therapy in person, they would see their child learning during every session.

**Conclusions**

**Discharge Recommendations:**

1. *Parental Involvement:* Continue to encourage the parents to try to attend Adrian’s therapy sessions and to become a more active part of his life. Additionally, limiting Adrian’s time spent with the television and videogames at home could encourage Adrian to participate in more occupations that can give him sensorimotor benefits.

2. *Oral awareness/sensitivity:* Continue to encourage gum chewing to encourage better modulation to possibly limit the amount of fingernail chewing. Pairing gum with a meaningful activity seems to be the most successful way to accomplish both tasks. Additionally, continue to try foods such as yogurt and pudding to find a flavor that Adrian enjoys to the extent he is willing to overcome the texture.

3. *Interactions with others:* Since Adrian did not improve with greetings for peers, this is an area that needs to be strongly emphasized. Hopefully, after a reminder Adrian will be able to formulate a greeting independently without scripting from the therapist. Additionally, Adrian should become part of a group therapy session in the future to learn how to interact with others in regards to rules and conversations.
4. **Visual-motor:** Continue to work with a variety of visual perceptual games. Since these skills are tough for Adrian to attend to, getting him in a quiet environment will hopefully help his concentration. Additionally, combining visual motor, fine motor, and tactile games together would help Adrian get the most out of his treatment in smaller amounts of time to help with his attention.

5. **Bilateral tasks and motor planning:** Novel bilateral tasks are one of the most important occupations to continue with Adrian. He is very close to skipping, but cannot attend longer than three minutes on bilateral tasks that are boring to him. This was one of his weakest areas on the Bruinincks Assessment. He needs to be encouraged to do novel bilateral activities to develop better motor planning skills.

6. **Handwriting:** Continue to review lower case letters Adrian already knows. Without high repetition, Adrian forgets the motor plans he has already mastered. Slowly adding new letters using a variety of mediums such as dry erase board, chalk board, and outside with chalk will help maintain his attention. No more than two letters should be introduced during one therapy session. Finally, continue to send homework with Adrian and his grandmother to review what was learned in therapy.
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Works Cited


### Appendix A

**CLINICAL OBSERVATIONS: Adapted from J Ayres**

<table>
<thead>
<tr>
<th>NAME: ___________________________</th>
<th>AGE: ___________</th>
<th>DATE: ________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=Normal</td>
<td>S=Slightly irregular/deficient</td>
</tr>
<tr>
<td><strong>MUSCLE TONE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>S</td>
</tr>
<tr>
<td>-feels “mushy” on palpation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-shoulders elevated/hunched</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-lordosis, hyperextends knees in standing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-fixes pelvis in anterior or posterior tilt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-w sitting</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CO-CONTRACTION:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>S</td>
</tr>
<tr>
<td>-fixes whole body</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-elevates shoulders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-slow to respond to being pushed/pulled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-poor comprehension of task</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Proximal joint stability in quadruped:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>-Assumes, but does not maintain weightbearing</td>
</tr>
<tr>
<td>-Lordosis, hyperextends/locks elbows, scapular winging</td>
</tr>
<tr>
<td>Hand adjustment in weight bearing: open/flat propped with flexed MPs</td>
</tr>
<tr>
<td>Prone extension:</td>
</tr>
<tr>
<td><strong>N (&gt;30s)</strong></td>
</tr>
<tr>
<td>4 year olds: 10 -15 seconds (high variability)</td>
</tr>
<tr>
<td>6 year olds: 20 seconds or more</td>
</tr>
<tr>
<td>Assumes:</td>
</tr>
<tr>
<td>Head:</td>
</tr>
<tr>
<td>on mat</td>
</tr>
<tr>
<td>Upper trunk:</td>
</tr>
<tr>
<td>on mat</td>
</tr>
<tr>
<td>Thighs:</td>
</tr>
<tr>
<td>on mat</td>
</tr>
<tr>
<td>Knees:</td>
</tr>
<tr>
<td>on mat</td>
</tr>
<tr>
<td>Effort:</td>
</tr>
<tr>
<td>-abducts upper or lower extremities</td>
</tr>
<tr>
<td>-holds arms backwards in extension</td>
</tr>
<tr>
<td>-holds hands clasped in front</td>
</tr>
</tbody>
</table>

| **Supine flexion**                       |                 |                      |
| **N (>20s)**                             | **S (10/20 w/effect, poor quality)** | **D (unable, <9s)** |
| 4 year olds: 10-15 seconds (high variability) | 5 year olds: 11-20 seconds | 6 year olds: 20 seconds with moderate exertion and moderate resistance |
| Assumes:                                  |                        |
| Chin:                                     | N:                 | S:     | D:                         |
| Effort:                                   | N:                 | S:     | D:                         |
| knees                                     | smoothly/quickly, all at once | slight head lag | leads with chin, head lag |
|                                          | Moderate exertion   | Considerable effort | Can’t assume, tries to hold |
### Sensory Integration as a Foundation for Learning

#### POSTURAL ADJUSTMENTS

<table>
<thead>
<tr>
<th></th>
<th>N (Appropriate postural adjustments)</th>
<th>S (Slightly irregular postural adjustments)</th>
<th>D (Exaggerated, awkward, inappropriate, delayed postural adjustments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor positioning of chair at table</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moves around a lot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asymmetrical posture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Works standing up</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Holds head/leans against table or on forearms
- Shoulder: abducted, elevated, protracted - fixed
- Turns work/paper
- Shoulder: abducted, elevated, protracted - fixed
- Slips down in chair/sacral
- Leans forward/eyes close
- Does not stabilize with non-dominant hand

#### SLOW MOVEMENTS

<table>
<thead>
<tr>
<th></th>
<th>N (Smooth)</th>
<th>S (Sit. Irregular)</th>
<th>N (Jerky, too fast)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymmetrical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elbows down</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Not full extension

#### STANDING BALANCE

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyes closed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### STNR

<table>
<thead>
<tr>
<th></th>
<th>N (no change)</th>
<th>S (slight change, trunk sags)</th>
<th>D (def. change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quad position R arm/skull side</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L arm/skull side</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIP position assume</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### ATNR

- Quad position R arm/skull side
- Quad position L arm/skull side
- RIP position assume

#### EQUILIBRIUM REACTIONS

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>S</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long sitting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quadruped</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upright kneeling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting on therapy ball</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Fearful on unstable surface
- Limited pelvis mobility when touching toes
- Trunk rotation - elongation on
- Lateral flexion only
- Premature protective extension

#### PROTECTIVE EXTENSION

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>S</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Falls over/ slow recovery
- Weightbearing fixed – legs cross over

#### GRAVITATIONAL INSECURITY

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>S</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme need to hold on or to try and see (e.g. lifting head)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Difference with active versus passive movement

#### SCHILDER’S TEST

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>S</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choreoathetosis/tremors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trunk rotation (&gt;45 degrees)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arms raised/drifting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak balance with eyes closed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Poor postural stability (e.g. arms drop)
- Head resistance
- Elbows hyperextend
- (Most 5 year olds can maintain position with eyes closed)

#### BILATERAL MOTOR COORDINATION

<table>
<thead>
<tr>
<th></th>
<th>Ipsilateral leg slap:</th>
<th>Contralateral leg slap:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hopping</td>
<td>Left</td>
<td>N</td>
</tr>
</tbody>
</table>

- L/R differences
Sensory Integration as a Foundation for Learning

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>S</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HOPPING JUMPING SEQUENCE:** Modify for 4-5 year olds: jumping forwards with legs opening and closing

Hop jump hop jump N S D
Hop hop jump/ jump jump hop N S D
R jump L jump N S D

**JUMPING JACKS**

- Stride jumps: Ipsilateral N S D - 4yr olds can do arms or legs but not both
- Contralateral N S D - modify for 5 year olds: start with arms shoulders and legs astride

**GALLOPING**

**SKIPPING:** Mature at 6-7 N S D

**PROJECTED ACTION SEQUENCES**

- Kick stationary ball N S D
- Kick moving ball N S D
- Run and kick moving ball N S D
- Throwing N S D
- Catching N S D

**PRAXIS:**

- uses trial and error
- needs direction/guidance/demonstration
- difficulty with verbal directions
- avoids novelty

**EYE PREFERENCE**

- through hole in hand R L R L
- through roll/hole in paper R L R L
- through kaleidoscope R L R L

**EYE MOVEMENTS**

- maintain visual focus N S D
- dissociate head/eyes N S D
- across midline N S D
- pursuits N S D
- convergence N S D
- quick localization N S D

**HAND FUNCTION:**

- DOMINANCE R L Both
- TRIPOD QUADRIPOD LOW TONE/INDEX GRIP DIGITAL PRONATE OTHER:
- FISTED TOO LOW ON PENCIL LIGHT INCONSISTENT
- HARDS JUST RIGHT
- PENCIL WRAP LATERAL THUMB
- INCONSISTENT
- STATIC EMERGING DYNAMIC DYNAMIC
<table>
<thead>
<tr>
<th>WHOLE ARM/SHOULDER WRIST MOVEMENTS</th>
<th>ISOLATED FINGER MOVEMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web space: OPEN</td>
<td>PARTIAL REDUCTION</td>
</tr>
<tr>
<td>Hand arches: DEVELOPED</td>
<td>FLAT</td>
</tr>
<tr>
<td>Wrist: NEUTRAL</td>
<td>FLEXION</td>
</tr>
</tbody>
</table>

**DIADOKOKOKINESIA** (Only matures by 7-8)
- right ________  N  S  D
- left ________  N  S  D
- both ________  N  S  D

**THUMB FINGER TOUCHING** (Difficult < 3)
- right ________  N  S  D  -snap R  L
- left ________  N  S  D  -spin R  L
- both ________  N  S  D

**IMITATION OF FINGER POSTURES:**  N  S  D  whole hand  simple

**IN-HAND MANIPULATION/TRANSLATION MOVEMENTS:**  N  S  D
- tries to help with other hand
- keeps dropping
- extends whole hand with release
- difficulty placing with pincer grasp

**TOOL-USE:**  tea strainer  tongs  chop sticks  pickle grabbers
- can’t use tools correctly independently
- needs demo/hand-over-hand assistance
- difficulty maintaining finger positioning
- reverts to stabilizing against palm instead of thumb
- poor endurance/can’t maintain

**FINGER-TO-NOSE TEST**  N  S  D
5 year olds touch within 1cm of nose without vision
7 year olds should not miss nose or finger more than once

**CUTTING SAMPLE:**  R  L  -hand pronated-wrist flexion  -poor bilateral hand use
- uses whole hand

**TONGUE-LIP MOVEMENTS**
- upper lip  N  S  D  -side wag  N  S  D
- lower lip  N  S  D  -clicking  YES  NO
<table>
<thead>
<tr>
<th>-full circle</th>
<th>N</th>
<th>S</th>
<th>D</th>
<th>-whistle</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
</table>