

Case Report: Effects of TheraTogs™ on the Postural Stability and Motor Control of a 7-year-old Girl with Down Syndrome and Severe Motor Delays

Phyllis A. Fenneman, PT, DPT¹; Julie D. Ries, PT, PhD²

1- Department of Physical Therapy, Evansville Vanderburgh School Corporation, Evansville, IN
2- Department of Physical Therapy, Marymount University, Arlington, VA

Background and Purpose

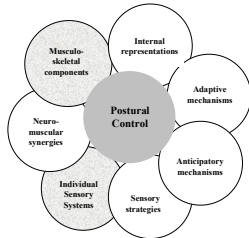
Children with Down syndrome (DS) are frequently encountered in the public school environment and may be eligible for physical therapy services due to motor delays. The physical therapist's task of serving the student with DS and severe motor delays can be challenging. This case report explores the use of a TheraTogs™ garment and strapping system as an intervention strategy to improve the postural stability and motor control of a 7-year-old girl with DS and severe motor delays.

Down Syndrome

- Incidence: 1 in every 733 live births
- Common Characteristics: congenital heart defects, generalized hypotonia, ligamentous laxity, cognitive deficits, developmental delays
- Research in motor development in children with DS demonstrates
 - Deficits in the postural control system
 - Definite trends in the rate of motor development with predicted probability that 100% of children with DS will be able to sit by 24 months, stand by 48 months, walk by 60 months, and crawl and roll by 72 months¹
 - Literature search reveals interventions used to improve postural stability in children with DS include ankle foot orthoses, neurodevelopmental treatment, and the use of somatosensory and visual information to reduce body sway.

TheraTogs™: (Therapy You Wear™) An orthotics undergarment and strapping system made of a unique elasticized, latex-free, Velcro® sensitive fabric designed to improve body awareness, postural stability, and resting and functional joint alignment during therapy, as well as during performance of activities of daily living.

- Lack of evidence in literature to support use to improve postural stability and motor control in children with DS
- Selected as the trial intervention strategy to improve the postural stability and motor control in student with DS and severe motor delays due to system features
- TheraTogs™ system offered the opportunity to incorporate joint proprioceptive input (individual sensory system) and constrain movement while improving biomechanical alignment (musculoskeletal components), both elements of systems influencing postural control



Systems contributing to postural control. Shaded areas represent the degrees of freedom being modified and manipulated by TheraTogs™ application. (Adapted from Shumway-Cook A, Woolacott MH. Motor Control: Theory and Practical Applications. 2nd ed. Philadelphia: Lippincott Williams and Wilkins, 2001).

Case Description

• Subject

- Age: 7 years, 6 months
- Diagnosis of Down syndrome (DS)
- Additional Relevant Medical History
 - Atrioventricular (AV) canal defect - surgical repair at 1 year of age
 - CT scan and MRI at 7-8 months reveals neurologic abnormalities
 - Gastrostomy (G-tube) at 10 months - closure at 6 years of age
 - BMI: 16.7 (71st percentile)
- Motor delays classified as Severe¹ for children with DS
 - Generalized hypotonia
 - Distal mild hypertonia in plantarflexors (1 on Modified Ashworth Scale)²
 - Requires ankle foot orthotics
- Restricted motor repertoire
 - CAN
 - roll
 - scoot in sitting on bottom
 - walk in gait trainer
 - full trunk support
 - CANNOT
 - transition in prone to 4 point
 - tall kneel
 - standing
 - crawl
 - stand without support
 - walk with one hand held



Figure 1. TheraTogs™ application: tank top is anchored to the hipster on all sides at the waist; the large split straps anchor laterally; two abdominal stretch straps recruit abdominal muscles.



Figure 2. K demonstrates new skills: independent 4 point and tall kneel positions while wearing TheraTogs™.

• Intervention

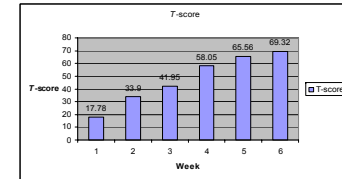
- Two-week training period
 - Child, family and staff adjustment
 - TheraTogs™ (Figure 1)
- Intervention period
 - Garment use
 - 6 hours a day for 6 weeks
 - throughout her school day
 - Physical therapy continued 2x/week
 - School staff targeted functional goals throughout the day.
 - Family continued the pre-intervention home program.

• Measurement

- The Gross Motor Function Measure (GMFM)³
 - Baseline and post-intervention
- Goal attainment scale (GAS)⁴
 - Selected developmental goals
 - independent standing
 - walking distances with one hand held
 - attainment of 4 point
 - maintenance of balance in 4 point

Outcomes

T-score chart: K's incremental progress on the GAS



| GMFM Dimension | Pre | Post | % Change |
|-------------------------------|--------------|--------------|--------------|
| A. Lying and Rolling | 88.2% | 96.1% | 9.0% |
| B. Sitting | 68.3% | 90.0% | 31.8% |
| C. Crawling & Kneeling | 9.5% | 50.0% | 426.3% |
| D. Standing | 0% | 0% | 0% |
| E. Walking, Running & Jumping | 8.3% | 8.3% | 0% |
| Total | 34.9% | 48.9% | 40.1% |

Discussion

- Positive outcomes with measurable increases in postural stability and motor control were documented using the GMFM and the GAS.
- Change analyzed from a systems approach: TheraTogs™ may have functioned as the control parameter that acted as the primary catalyst for K's postural and motor changes.
- TheraTogs™ modified and manipulated components of the musculoskeletal and sensory systems to accomplish the following: corrected biomechanical alignment; increased proprioceptive input which improved K's percept of correct spatial orientation and mapping; and increased her trunk stiffness, which improved her proximal stability and reduced the number of body segments K needed to coordinate when trying to balance and move.
- More research needs to be performed that explores the use of TheraTogs™ to support the development of postural stability and motor control in children with DS and severe motor delays.

References

1. Palisano RJ, Walter SD, Russell DJ. Gross motor function of children with Down syndrome: creation of motor growth curves. Archives Phys Med Rehabil. 2001;82:494.
2. Bohannon RW, Smith MB. Interrater reliability of a Modified Ashworth Scale of muscle spasticity. Phys Ther. 1987;67:206.
3. Russell D, Palisano R, Walter S. Evaluating motor function in children with Down syndrome: validity of the GMFM. Dev Med and Child Neuro. 1998;40:693-701.
4. Kiresuk TJ, Smith A, Caudillo JE. Goal Attainment Scaling: Applications, Theory, and Measurement. New Jersey: Lawrence Erlbaum Associates;1994.