

## TheraTogs Research Publications and Posters - Annotated by Beverly Cusick PT, MS, NDT, COF

None of these projects was initiated or paid for by TheraTogs Inc.

Abd El-Kafy EM. 2014. The clinical impact of orthotic correction of lower limb rotational deformities in children with cerebral palsy: a randomized controlled trial. *Clin Rehabil.* 28(10):1004-14. [This study included 57 children of both sexes, aged 6 to 8 years. **STUDY DESIGN:** Three-armed randomized control trial. **INTERVENTION:** Participants in all groups received a traditional neuro-developmental physical therapy program that included standing and gait training exercises. Children in group A performed the training program with no orthotic management, in group B with the TheraTogs strapping system, and in group C with the TheraTogs strapping system and static ground reaction AFOs. Children underwent treatment for two hours daily, except on weekends, for twelve successive weeks. **MAIN MEASURE:** Gait speed, cadence, stride length, and hip and knee flexion angles in the mid-stance phase were evaluated pre-and post-treatment using a three-dimensional motion analysis system (pre-reflex system). **RESULTS:** Statistically significant differences were recorded among the three groups post-treatment in gait speed, cadences, and stride length. Significant post-treatment differences were also recorded for bilateral hip-and knee-flexion angles. For all measured parameters, Group C showed the greatest gains. **CONCLUSION:** Orthotic intervention composed of a static ground reaction AFO combined with the TheraTogs strapping system improves gait more than conventional treatment with or without TheraTogs in children with spastic diplegic CP.]

This researcher shows the novice level of understanding of the significance of trunk alignment and of postural control that I had in 2004 when I strapped the lower limbs for intoeing without first addressing the pelvis and spine and anteriorly displaced body weight loading. I would have 1) assessed femoral torsion status before applying rotation strapping; 2) assessed ankle DFROM at R1A end range to determine optimum ankle angle in AFOs; 3) tuned the AFOs as needed to accommodate R1A end range; 4) collected data with AFOs first; 5) added the TheraTogs with torso alignment strapping vs. LE rotation strapping and collected data; 6) added safe LE rotation strapping and evaluated effects; and 7) had the wearers live in their orthotic systems at least 6 hrs/day vs. 2 hours per day on week days.

Dudek J, Michalska A, Linowski M, Tarasow-Zych A. 2012. The effect of Thera Togs on postural stability in patients with central hypotonia. Preliminary report. *Fizjoterapia Polska*; 3(4); Vol. 12, 275-284. *Kombinezon TheraTogs a stabilność posturalna pacjentów z centralną hipotonią. doniesienie wstępne.* [Polish] [www.publisherspanel.com](http://www.publisherspanel.com) [TheraTogs suit and the postural stability of patients with central hypotension. preliminary report]. In: "Tacy is Teśmy!" Current Problems of Care, Diagnosis and Therapy of People with Multiple Disabilities, conference proceedings, pp 119-128. Kraków: Libron and Authors Publishing House, 2012. [Publication in Slovenic] [The study group included 8 children with cognitive deficits, ages 7 through 13 years, all able to stand independently for  $\geq 20$  seconds. Diagnoses included postural hypotension associated with Rett syndrome (1), cerebral palsy (2), CNS malformation (2), neurodevelopmental disorder (1), and Down syndrome (2). Postural stability was measured using the FDM-S dynamographic platform that records center of pressure data in static standing with eyes open. Standing stability was assessed 3 times on the same day: 1) before donning TheraTogs; 2) at 1 hour after donning it; and 3) after 6 hours of wear. **RESULTS:** After the first hour of suit wear, no statistically significant differences were found in the shape of the ellipses formed by movements of the body COP. After 6 hours, individual and mean decreases in ellipse features were recorded in this sequence of significance: 1. the width ( $p = 0.025$ ); 2. the area ( $p = 0.035$ ), and 3. the height ( $p = 0.05$ ). **CONCLUSIONS:** On the basis of the obtained results, it can be concluded that the use of the TheraTogs suit improved postural stability in the studied patients, and the therapeutic effect increased with the wear time up to 6 hours. The use of the researchers' choice of corrective strap applications did not have a statistically significant effect on the improvement of the load symmetry of the lower limbs. A thorough evaluation of the therapeutic effect of the use of TheraTogs overall requires studies on a larger group of patients.]

El-Fiky AAR, Elsodany AM, El-Kafy AMR. 2016. Effect of TheraTogs orthotic undergarment on postural balance control, risk of fall, and walking abilities in Saudi individuals with chronic stroke. *Jokull Journal.* 66 (5): 23-35. [AIM: To evaluate the effectiveness of TheraTogs orthotic undergarment and strapping system on postural balance control, walking abilities, and risk of fall in Saudi individuals with chronic stroke. **METHOD:** Randomized controlled trial (RTC). The study included 30 males ages 40 to 50 years, with chronic stroke, randomly assigned to groups of 15 each (A: conventional PT without TheraTogs; and B: conventional PT plus TheraTogs garments with strapping system - hip LR & ABD-assist on the affected side - worn for 12 hours/day). Outcomes: overall stability indices for both dynamic postural stability and fall risk using the Biodex Balance System and gait velocity via 10 m walking test. **RESULTS:** Both groups improved more significantly comparing before and after the 2 months of therapy. Statistically significant post-treatment differences in all outcomes favored group B. **CONCLUSION:** The addition of the TheraTogs strapping system to the conventional PT program improved the balance control and walking abilities and reduced the risk of fall more effectively than traditional treatment.]

El Kafy, Ehab M. Abd; El-Shemy, Samah A. 2013. Modulation of Lower extremity rotational deformities using TheraTogs™ and strapping system in children with spastic diplegia. *Egyptian J Neurol, Psychiatry & Neurosurg.* 50(4):397-402. [This study was conducted to investigate the effect of TheraTogs™ and strapping system on femoral anteversion and external tibial torsion in children with spastic diplegia and to determine its effect on the child's gait. **Methods:** Thirty children with spastic diplegia from both sexes were randomly assigned into two equal groups. Their age ranged from six to eight years. Control group (A) treated by a designed gait training program, study group (B) received the same program as group (A) in addition to TheraTogs™ orthotics undergarment and lower extremity strapping bilaterally. Pro-Reflex 3-D system was used to measure rotation angles of hip and knee joints, gait velocity and foot progression angle. Pre and post assessment were performed for both groups following 3 months intervention phase (post<sub>1</sub>), another assessment time (post<sub>2</sub>) was added in group B during wearing TheraTogs™ and strapping system. **Results:** There was no significant difference in all measuring variables in group (A) when comparing its pre and post assessment. Significant improvement was observed in all measuring variables in group (B) when comparing its pre, post1 and post<sub>2</sub> assessment and when comparing the post treatment results of the two groups in favor of group (B) (P-

value <math>0.05</math>). Conclusion: The current study showed positive effect of using TheraTogs™ and strapping system on rotational abnormalities and gait pattern from a biomechanical perspective.]

**El-Kafy EM (Cited: Abd El-Kafy EM elsewhere), El-Shamy SM. 2022. The impact of conservative soft orthotic intervention with strapping on thoracic kyphotic posture and spinal mobility in children with cerebral palsy: a randomized control trial. Bulletin Faculty Physical Therapy. 27(1):1-8.** (Open Access) [AIMS: 1) to evaluate the influences of TheraTogs orthotic undergarment and strapping system on dorsal kyphotic posture and spinal mobility in children with spastic diplegic CP; 2) to investigate the impact of the modulation of thoracic kyphosis on balance and risk of falls in these children. DESIGN: RTC. 38 children with diplegic CP, ages 8 to 10 years were divided into study and control groups. METHODS: All children received conventional exercise for modulating thoracic kyphotic posture for 2 hrs, 3 x week for 12 weeks. Children in the study group also wore TheraTogs with the strapping system for 8 hrs every day. OUTCOME MEASURES: Before and after the 12 weeks, data were obtained re thoracic kyphosis angle, thoracic flexion and extension range of motion, the overall stability index of fall risk test, and the Pediatric Balance Scale score. RESULTS: Children in the study group showed significantly greater improvements in the scores of all measures compared to the control group ( $P < 0.05$ ). CONCLUSION: Conservative treatment composed of TheraTogs orthotic system with conventional exercise treatment is effective in modulating thoracic kyphosis and improving dorsal range of motion in children with spastic diplegic CP. This improvement in alignment has a positive influence on postural balance and reduces the risk of fall in these children ]

**El-Shamy SM, El-Kafy EM (Cited: Abd El-Kafy EM elsewhere). 2022. Combined effect of orthotic intervention and conventional exercise training on balance and gait performance in cerebral palsy: a randomized controlled trial. Bull Faculty Physical Therapy. 27(1):1-7.** (Open Access) [DESIGN: RTC. 40 children with dyskinetic CP, M&F, ages 12 to 16 years were divided into 2 groups. Pediatric Balance Scale (PBS) score and postural stability indices (overall, anteroposterior, and mediolateral) were evaluated by the Biodex Balance System before and after 12 weeks of treatment. Step length, gait cycle time, cadence, and velocity were measured by an electronic walkway. RESULTS: Children in the study group showed significantly greater improvements than the control group in the scores of all the measured variables post-treatment ( $P < 0.05$ ). CONCLUSIONS: TheraTogs increased the effectiveness of conventional therapeutic exercise training in improving balance and gait performance in children with dyskinetic CP. ]

**Elhert R, Manfio EF, Heidrich RdO, Goldani R. 2017. Cerebral palsy: Influence of TheraTogs on gait, posture and in functional performance. Fisioterapia em Movimento. 30:307-17.** Case study. [AIM: To evaluate the influence of TheraTogs on the posture, distribution of plantar pressure during gait and functional performance of a child with spastic diplegic CP. METHODS: An 11-year-old child with diplegic CP underwent postural assessment using Postural Assessment Software (PAS) and plantar pressure distribution assessment during barefoot gait through the Emed-X system, before and after the intervention period of 8 weeks; and functional assessment (PEDI) with and without TheraTogs. RESULTS: TheraTogs had greater influence on standing hip extension and this change was greater during its use. An increase in posteriorization of plantar pressure occurred at IC while the push-off and initial swing phases improved. The child showed improvements in functional mobility, however, self-care ability with TheraTogs was reduced. CONCLUSION: Although improvements in posture, gait and functionality related to TheraTogs use were verified, the excessive heat, difficulties in toileting and self-care were disadvantages in wearing TheraTogs. Great data about the plantar pressure moving posteriorly. This researcher put the Hipster on OVER panties, so there were unnecessary toileting problems. Product instructions are to don them UNDER underwear. She also did not "summerize" the garments as suggested on the theratogs.com website.

**Feldman C, Robinson CE. 2005. The effects of TheraTogs™ on the gait and function of a child with spastic diplegic cerebral palsy. <https://commons.pacificu.edu/work/sc/b1353c62-03c6-4587-99ab-652d82688d1f>** [Methods: A single subject design (ABA withdrawal) was conducted with a 7 year old female with spastic diplegic cerebral palsy. The intervention of TheraTogs™ was worn for 6 consecutive hours every day for 3 weeks. Gait parameters (cadence, velocity, stride length, degrees of toe in/out) were assessed using the GAITRite® system. Function was assessed with the Gross Motor Function Measure (GMFM). Data was analyzed using the two-standard deviation band method. RESULTS: Statistically significant changes were made in the gait parameters of cadence, velocity, right toe-in/out either during the intervention or carryover phases. However, no statistically significant changes were made in the gait parameters of stride length or left toe-in/out. A decrease in the percentage of the standard deviation between the baseline and intervention phases and the baseline and carryover phases was found in all the gait parameters except for right toe in/out, indicating a decrease in the subject's gait variability over the course of the study. The subject increased her GMFM scores between the baseline and carryover phases in standing from 85% to 92% and in walking, running and jumping from 81 % to 86 %. Discussion and Conclusion: The data illustrated that the therapeutic garment had statistically significant effects in the areas of cadence, velocity and right toe-in/out and reduced the amount of variability in this subject's gait in all the gait parameters tested. Through clinical observation, the garment limited the amount of excessive lateral trunk movement, decreased toe-in on the right foot, and increased heel strike, resulting in a more consistent gait pattern. The continuation of studies involving therapeutic garments will help to establish this technique as an evidence based intervention for improving gait patterns and functional skills.

**Fenneman P, Ries JD. 2010. Effects of TheraTogs on the postural stability and motor control of a 7-year-old girl with Down syndrome and severe motor delays. Poster presented at APTA Combined Sections meeting, Feb.** [Positive outcomes with measurable increases in postural stability and motor control were documented using the GMFM and the GAS. TheraTogs™ modified and manipulated components of the musculoskeletal and sensory systems to accomplish the following: corrected biomechanical alignment; increased proprioceptive input which improved subject'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 she needed to coordinate when trying to balance and move. Change analyzed from a systems approach: TheraTogs™ may have functioned as the control parameter that acted as the primary catalyst for subject's postural and motor changes.] This researcher strapped the trunk. The GMFM score for crawling & kneeling for this child increased 426.3%!

**Flanagan A, Krzalz J, Peer M, Johnson P, Urban M. 2009.** Evaluation of short-term intensive orthotic garment use in children who have cerebral palsy. *Pediatr Phys Ther.* Summer;21(2):201-4. [METHODS: Five subjects (ages 7-13 years) with CP at GMFCS level I wore a TheraTog undergarment for 12 weeks. Data collection included Vicon Motion Analysis, Bruininks-Oseretsky Test of Motor Proficiency, and Canadian Occupational Performance Measure at baseline; in and out of the garment after 12 weeks of wear; 2 months and 4 months after garment wear. RESULTS: Kinematic data indicated increased peak hip extension and correction of anterior pelvic tilt in stance during wear time. Composite gross motor scores on the Bruininks-Oseretsky Test and Canadian OPM scores improved significantly at the end of wear time and increased further 2 & 4 months after wear was discontinued. CONCLUSION: When worn for 12-weeks, an individualized orthotic garment can improve gait and functional skills in some children with CP.]  
These researchers strapped the abdominals on all 5 subjects.

**George KW, Sweeney JK, Bjornsen KJ, McCoy SW. 2011.** The effectiveness of a dynamic orthotic and strapping system on gross motor function in children with cerebral palsy Doctoral thesis and poster presentation at meeting of the APTA, NJ Chapter . [Subjects: Eleven children (age 4-11 years) with CP, stratified by the Gross Motor Function Classification System (GMFCS) at Level I-III, were alternated into groups based on the date of parental consent. Method and materials: Intervention was application of a TheraTogs garment and strapping system with therapeutic or sham application. Sham garment was applied without any pull or resistance from elastic strapping or garment itself. Functional change was measured by Dimensions D&E of the GMFM-66, and temporal/spatial gait parameters on a paper and ink pedograph. After baseline testing, the intervention was applied by parents and worn for 8 weeks, 6 hours a day, 5 days a week at minimum. Parents completed a questionnaire and were interviewed about garment use and progress observed in their children. Scorers were masked to the study purpose and phase. Data analysis: GMFM-66 and pedograph scores - Paired samples t-test comparing pretest to post-test scores were used for within groups testing and independent samples t-test using post test scores for between groups testing were used. Results: Positive trends in gross motor skills on the GMFM-66 occurred only for the intervention group. These trends were above published Minimal Clinically Important Difference (MCID) standards.]  
Parents generally know their children well and can appreciate changes.

**Harel Y, Atun-Einy O, Lotan M. 2017.** Pressure undergarments as means to improve sensory motor, function and emotional behavior of a child with autism spectrum disorder: A history case report. *Autism-Open Access.* 7(220):2. [AIM: To explore the feasibility and effect - on motor, sensory capabilities and behavior of a child with ASD - of an orthotic undergarment (OUG) as a supplementary therapeutic modality. (TheraTogs). PARTICIPANT: A child with ASD, age five years and eight months, who presents hypotonia, poor postural control and coordination, a significant motor delay, severe sensory modulation problems, and disruptive behaviors. PROCEDURE: Motor, sensory and behavioral evaluations were performed pre (Pre-I) and after (Post-I) a four months intervention: Peabody Developmental Motor Scales-2 (PDMS-2), The Short Sensory Profile (SSP), therapists' reports and parental interviews served as a behavior and emotion evaluation. RESULTS: Motor function has improved (PDMS-2 percentile <1 Pre-I vs. Post-I 3). Sensory function has improved (Total SSP score 136 Pre-I vs. Post-I 102). Therapeutic and parental reports indicated a decrease of atypical behaviors, improvement in self-confidence and better social participation. CONCLUSION: According to the current case report, the OUG was found to be useful in improving sensory-motor functions and emotional behaviors of a child with ASD. Our findings provide a possible support to the introduction of an orthotic undergarment as a part of individually tailored PT interventions for the child with ASD.]

**Jung J, Cho H, Lee G. 2021.** Immediate effects of orthotic garment and strapping system on balance and gait in children with spastic diplegia. *Neurology Asia.* 26(2):355-360. [TheraTogs, a orthotic garment and strapping system that is known to improve postural alignment, joint stability, and movement efficiency. However, few studies on children with cerebral palsy have investigated its effect on balance and gait. The purpose of the study is to investigate the immediate effects of TheraTogs used as orthoses on the balance and gait of children with spastic diplegic cerebral palsy. This study used a cross-over design. A total of 24 children (aged 3–14 years) with spastic diplegic cerebral palsy participated. Balance and gait were analyzed using the force plate and GAITRite pre- versus post-TheraTogs use. Sway velocity, sway path, and sway area post-TheraTogs use significantly improved compared to pre-TheraTogs use ( $p < 0.05$ ). Regarding spatiotemporal gait parameters, post-TheraTogs use, gait velocity, cadence, step length, stride length, single support time, and double support time significantly improved ( $p < 0.05$ ). Our results suggest that TheraTogs could be utilized as a useful posture orthosis to help improve the balance and gait of children with spastic diplegic cerebral palsy. However, further high-quality studies are required to validate our findings. ]

**Jung J, Jeong J, Lee D, et al. 2019.** Comparison of spatio-temporal gait parameters depending on using TheraTogs in children with spastic cerebral palsy. *Curr Pediatric Res.* 23(1):1-5. [The purpose of this study was to compare the spatio-temporal gait parameters of children with spastic cerebral palsy wearing the TheraTogs suit. Methods: A total of 10 children with spastic cerebral palsy participated, and the GAITRite was used to analyze and compare the spatio-temporal gait parameters (gait velocity, cadence, step length, stride length, single support time, and double support time) of children with cerebral palsy while wearing and not wearing the TheraTogs. Results: There was a significant difference in the gait velocity, cadence, step length, stride length, single support time, and double support time between conditions with-and without the TheraTogs ( $p < 0.05$ ). Conclusion: The results of this study show that the use of TheraTogs in children with cerebral palsy may have positive effect to improve the gait ability.]

**Kafy E, Abd EM Author is also cited: Abd El-Kafy EM, El-Shemy SA. 2013. Modulation of lower extremity rotational deformities using TheraTogs™ and strapping system in children with spastic diplegia. Egyptian J Neurol, Psychiatry, Neurosurg. 50(4).** Open Access. [AIM: To investigate the effect of TheraTogs™ and strapping system on femoral anteversion and external tibial torsion in children with spastic diplegia and to determine its effect on the child's gait. METHODS: Thirty children with spastic diplegia from both sexes – ages 6 to 8 years - were randomly assigned into two



equal groups. Control group (A) was treated by a designed gait training program. Group (B) received the same program as group (A) in addition to TheraTogs™ orthotics undergarment and lower extremity strapping bilaterally. Pro-Reflex 3-D system was used to measure rotation angles of hip and knee joints, gait velocity and foot progression angle. Pre and post assessment were performed for both groups following 3 months intervention phase (post<sub>1</sub>), another assessment time (post<sub>2</sub>) was added in group B during wearing TheraTogs™ and strapping system. **RESULTS:** Group A showed no significant difference in all measuring variables when comparing its pre and post assessment. Group B showed significant improvement in all measuring variables when comparing its pre, post1 and post<sub>2</sub> assessment. Post treatment results of the two groups favored group (B) (P 0.05). **CONCLUSION:** The current study showed positive effect of using Theratogs™ and strapping system on rotational abnormalities and gait pattern from a biomechanical perspective.]

This researcher is also cited as Abd El-Kafy EM and shows the level of understanding of the significance of trunk alignment and of postural control that I had in 2004 when I strapped the lower limbs for intoeing without first addressing the pelvis and spine and anteriorly displaced body weight carriage.

**Kafy E Abd EM** (Cited: *Abd El-Kafy EM elsewhere*), **EI-Shamy SM. 2021. Efficacy of TheraTogs orthotic undergarment on modulation of spinal geometry in children with diplegic cerebral palsy. Bulletin Faculty Physical Therapy. 26(1):1-8.** [AIM: to investigate the efficacy of TheraTogs orthotic undergarment on modulation of spinal geometry in children with diplegic CP. **DESIGN:** RCT. 40 children with diplegic CP, ages 6 to 9 yrs, were randomly assigned to (1) an experimental group that received TheraTogs orthotic undergarment (12 h/day, 3 days/week) plus traditional PT for 3 successive months; and (2) a control group that received only traditional PT for the same time period. Spinal geometry was measured at baseline and after 3 months of intervention using the Formetric system. **RESULTS:** Children in both groups showed significant improvements in the spinal geometry (P < 0.05), with significantly greater improvements in Group 1. **CONCLUSIONS:** TheraTogs orthotic undergarment may be a useful tool for improving spinal geometry in children with diplegic CP.]

**Maguire C, Sieben JM, Scheidhauer H, Romkes J, Suica Z, de Bie RA. 2016.** The effect of crutches, an orthosis TheraTogs, and no walking aids on the recovery of gait in a patient with delayed healing post hip fracture: A case report. *Physiother Theory Pract.* 32(1):69-81. Switzerland. [clare.maguire@bzgbs.ch](mailto:clare.maguire@bzgbs.ch) [AIM: to document the effect of walking with crutches; an orthotic garment and strapping system, TheraTogs; and no walking aids over 3–4-week periods on walking speed, trunk sway, and muscle activity measured with electromyography (EMG). Subject: 49-year-old female showing delayed healing following a conservatively treated avulsion fracture of the greater trochanter 12 weeks previously with a 14-year history of total hip arthroplasty. **EMG analysis showed muscle activity increased with TheraTogs and decreased with crutches compared with walking with no aids. Walking speed improved at a faster rate in the TheraTogs phase than in the crutches phase and reduced in no-walking-aids phase.** Mean speed (SD) for each phase was: crutches 1.11 (0.08) m/s, TheraTogs 1.35 (0.11) m/s, and no-aids 1.19 (0.14) m/s. **Trunk sway increased in the crutch and no-aids phases, and became more stable in the TheraTogs phase. In this patient, function and recovery rate of all measured parameters increased more in the TheraTogs phase than the crutches or no-aids phase. This may be because muscle activity was facilitated enabling active support of recovering structures.]**

**Maguire C, Sieben JM, Frank M, Romkes J. 2010.** Hip abductor control in walking following stroke -- the immediate effect of canes, taping and TheraTogs on gait. *Clin Rehabil.* Jan;24(1):37-45. Switzerland. [clare.maguire@bzgbs.ch](mailto:clare.maguire@bzgbs.ch) [To confirm previous findings that hip abductor activity measured by electromyography (EMG) on the side contralateral to cane use is reduced during walking in stroke patients. To assess whether an orthosis (TheraTogs) or hip abductor taping increase hemiplegic hip abductor activity compared with activity during cane walking or while walking without aids. To investigate the effect of each condition on temporo-spatial gait parameters. **DESIGN:** Randomized, within-participant experimental study. **SETTING:** Gait laboratory. **SUBJECTS:** Thirteen patients following first unilateral stroke. **INTERVENTION:** Data collection over six gait cycles as subjects walked at self-selected speed during: baseline (without aids) and in randomized order with (1) hip abductor taping, (2) TheraTogs, (3) cane in non-hemiplegic hand. **MAIN MEASURES:** Peak EMG of gluteus medius and tensor fascia lata and temporo-spatial gait parameters. **RESULTS:** Cane use reduced EMG activity in gluteus medius from baseline by 21.86%. TheraTogs increased it by 16.47% (change cane use-TheraTogs P = 0.001, effect size = -0.5) and tape by 5.8% (change cane use-tape P = 0.001, effect size = -0.46). In tensor fascia lata cane use reduced EMG activity from baseline by 19.14%. TheraTogs also reduced EMG activity from baseline by 1.10% (change cane use-TheraTogs P = 0.009, effect size -0.37) and tape by 3% (not significant). Gait speed (m/s) at: baseline 0.44, cane use 0.45, tape 0.48, TheraTogs 0.49. **CONCLUSION:** Hip abductor taping and TheraTogs increase hemiplegic hip abductor activity and gait speed during walking compared with baseline and cane use.]

This preliminary study provided evidence that elastic strapping to increase sensory input and to assist the hip abductors increased gluteus medius muscle recruitment in walking. TFL is a component of the iliotibial band complex and is mainly holding the IT Band in position in stance with the aid of the gluteus maximus fibers that also attach to the IT band. The crossed-hip strapping application mimicked the ITB, glut max, and TFL complex.

**Moore JG, Garton SR, Ryan EM, Sansone TM. 2008.** The effect of a TheraTogs™ garment on gross motor skill acquisition in a child with Prader-Willi Syndrome: Case Report. Poster – APTA – Combined Sections Meeting, February. [Data was collected: 1. at baseline (BAS), 2. after 6-weeks of PT without the TT garment (A1), 3. after 8-weeks of PT wearing the TT garment (including a one week adjustment period) (B), and 4. after 4-weeks of continued PT without the TT garment (A2). During phase (B), the child wore the TT garment with straps for 5 hours a day/7 days a week for 7 weeks. Elasticized strapping was applied to facilitate the following: 1) internal and external abdominal obliques, 2) trunk extensors, hip internal rotators, and hip extensors. **Results:** Performance was stable during the baseline phase. **During the TT phase, the raw score on the PDMS-2 increased 10 points in the locomotion dimension.** (Significant gain on PDMS-2 is 9.2 points.) **The GMFM-88 score for the dimension of crawling and kneeling increased 9.5%, and for standing, and walking, running, and jumping dimension increased 10.2%. (Significant gain on GMFM is 5.2%.)** Throughout all phases,

skills in the sitting dimension of the GMFM increased. **All scores continued to improve or were maintained after removal of the TT garment.]** The PT stated her appreciation for the TheraTogs "...because I didn't have to be a pretzel!"

**Richards A, Morcos S, Rethlefsen S, Ryan D. 2012.** The use of TheraTogs versus twister cables in the treatment of in-toeing during gait in a child with spina bifida. *Pediatr Phys Ther.* 24(4):321-6. [AIM: To compare the effects of TheraTogs and twister cables (TCs) on in-toeing during gait in a 2 y.o. child with L-4 spina bifida while comparing overall parent and patient satisfaction. Six weeks of intervention with TheraTogs (LR strapping) were followed by 6 weeks of TCs. Kinematic data indicated optimal foot progression with the use of TCs, achieved by the rotation of the lower leg. Gait data for the use of TheraTogs indicated improved foot progression with external rotation at the hips. Gait characteristics indicated improved gait velocity in TheraTogs, but stride length was better with TCs. **The parent reported satisfaction and preference for TheraTogs.** As the first step in investigating the 2 interventions, both TheraTogs and TCs were effective in management of in-toeing for the child but parental preference favored TheraTogs.]

The hip lateral ROM and femoral torsion findings reported here do not make sense, as the knees were in lateral rotation (LR) in function, and no child of age 2 years with spina bifida shows a total of 60° of hip rotation ROM. Without accurate assessment data, the authors did not use strapping that would have limited hip LR and promoted tibial LR. That's what TheraTogs can do that twistors cannot. So the results were compromised by the faulty use of the system under study.

**Rojas A, Weiss M, Elbaum L. 2008.** The effect of TheraTogs on the gait of a child with cerebral palsy: a case study. Florida International University Department of Physical Therapy, Miami FL. Poster presented at FIU Honors College Annual Research Conference, April. [AIM: To investigate the effectiveness of TheraTogs as a PT intervention for a child with spastic diplegia] **METHOD:** Subject: an eight-year-old boy with a diagnosis of spastic diplegic CP and no significant complicating past medical history. He ambulates with bilateral rigid AFO's is currently in PT to maximize function and gait efficiency. The APAS Gait analysis system was used to interpret the videos and analyze the child's gait without and with the TheraTogs system. Attention was focused on the child's right side (Right Initial Contact to Right Initial Contact). Data without and with TheraTogs were also compared to a normal gait cycle. **RESULTS:** In general we found the application of TheraTogs did improve the quality and efficiency of the child's gait. At each joint some improvement was noted signifying a gait pattern more closely resembling that of normal. Wider foot placement indicated reduction in scissoring. The knee presented with less flexion at IC and during swing. Hip motion during stance indicating more coordinated muscle activity between the flexor and extensor muscle groups. Lastly, the child's pelvis, trunk, and shoulders all showed less overall excursion and a more efficient, less energy consumptive gait pattern.]

**SefECKA A. 2008. Case Report:** The AtaxiTog System as an adjunct to traditional physical therapy intervention for a 13-year-old with postural instability post non-traumatic cerebellar injury. A Five-Week Program. Poster.

**Siracusa C, Taynor M, Geletka B, Overby A. 2005.** Effectiveness of a biomechanical intervention in children with spastic diplegia. *Pediatr Phys Ther.* 17(1): 83-84. Detailed Abstract, Poster Presentation. [Conducted at the Ohio University, PT Education Program, this study compared musculoskeletal status and temporal spatial gait features with and without TheraTogs for 2 school-aged children with CP. Poster presented at APTA Combined Sections Meeting, Feb, 2005. [Subjects: 3 children with diplegic CP: 2 on posterior walkers (ages 7 and 8 years), 1 Level 1 (age 3 years). 1 on walker is 5 years S/P SDR. Method: After obtaining a stable set of baseline findings, all subjects were fitted with TheraTogs and 2 sets of straps to shorten the abdominals and to facilitate hip lateral rotation. These researchers undertook pelvic and selected LE musculoskeletal assessments prior to and after the data gathering period, and derived additional, customized TheraTogs strapping plans relative to the assessment findings. Other data included GMFM scores obtained prior to and 1 week after discontinuing TheraTogs use; force plate data combined with videotaping re velocity, cadence, step length, and step width over a 6-meter distance. Caregivers kept a journal of their observations and experiences with the TheraTogs system. Conclusions: "A customized, soft garment with strapping system can improve functional skills, range of motion, and gait in some children with diplegia when applied over an 8-week time period. More research is needed to determine optimal parameters for hours of usage and duration of intervention; a larger sample size and a change in design to A-B-A are needed to determine the **efficacy of the system**".] **Authors used musculoskeletal assessment findings to establish a baseline and to target strapping applications. Several gains in LE ROM were significant.**

Sheehan, Stephanie. 2014. The use of an orthotic garment system on a pediatric patient with Mitochondrial Disease Complex 1+3: A Case Report. *Case Report Posters.* Poster 41. [https://dune.une.edu/pt\\_studcrposter/41](https://dune.une.edu/pt_studcrposter/41) [Background: Mitochondrial Disease (MD) is a progressive and debilitating disease that is characterized by a loss of efficiency in the electron transport chain and reductions in the synthesis of high energy molecules such as ATP. Orthotic garment systems also referred to as "TheraTogs®", have been designed to act as a continuous somatosensory guide for proper functional alignment. TheraTogs have been used in the pediatric population to treat Cerebral Palsy and Down Syndrome with excellent results but there is no known research regarding the benefits of TheraTogs® in individuals with MD. Purpose: To investigate the use of the TheraTogs® System for postural control, with a pediatric patient with Mitochondrial Disease Complex 1+3. **RESULTS:** With support of the TheraTogs®, the patient was able to perform all activities with improved postural control and endurance. Following 8 weeks of treatment, the patient was able to get into each test position independently and also independently maneuver stairs, curbs and ramps and was becoming more engaged with peers. The use of TheraTogs improved alignment, functional ability, and endurance in an 11 year-old pediatric patient with MD Complex 1+3. Further research should focus on investigating the benefits of TheraTogs® in younger and older patients with Mitochondrial Disease.]