

## TheraTogs Clinical Research Questions

### Effects of TheraTogs™ for Neuromuscular Re-education on Balance, Gait, Muscle Recruitment Patterns, Skeletal Geometry, Load-Bearing Joint Alignment, Energy Cost, Muscle Strength, Function, and ADLs

TheraTogs introduce a change in joint alignment or functional muscle length. Can you detect intervention-related alterations in EMG output/ strength (dynamometric measurements)/ GMFM score / PEDI score/ physiologic cost index (PCI)?

#### TheraTogs™ applications and EMG output

The fabric that comprises TheraTogs can be cut without fear of tearing. So electrodes and needles can be applied through holes in the fabric.

1. Does EMG activity change in magnitude or timing when you apply TheraTogs™ garments and a selected strapping system to facilitate such muscle groups and sites as:
  - Thoracic paraspinals
  - Lumbar paraspinals
  - Iliopsoas
  - Abdominals – Rectus abdominus vs. Obliques
  - Gluteus medius
  - Biceps femoris in stance / swing
  - Proximal hamstrings in stance
  - Gluteus maximus
  - Hip rotation strapping (to reduce or enhance medial rotation gait): *Is there a change in gluteus medius, gluteus maximus, TFL, quadriceps, hamstring muscle activation pattern or timing?*
  - To reduce knee hyperextension: *Is there a change in Gluteus maximus, quadriceps, Rectus femoris, hamstring muscle activation pattern or timing?*
2. Evaluate TheraTogs™ strapping applications for evidence of:
  - Reduction in selected postural and gait deviations, and influence on Energy Cost.
  - Influence of selected TheraTogs applications on GMPM, GMFM#66, PEDI scores.
  - Influence of 6 weeks of TheraTogs system wear on selected muscle strength findings – static and dynamic – using hand-held dynamometry.

#### Foot Print and Gait Velocity Studies

3. Spatial gait features include step length, stride length, and foot progression angle. Temporal features include cadence and velocity. What is the influence, on spatial and temporal gait features, of using TheraTogs strapping applications at the:
  - Paraspinals and/or shoulders to increase upper trunk extension and/or shoulder retraction.
  - To facilitate a shift of the center of body mass posteriorly: upper paraspinals, anterior oblique abdominals, and hips to promote extension.
  - Lumbar spine and anterior hips to increase lumbar lordosis and facilitate hip flexion.

- Hips to reduce medial rotation .
- Hips to reduce excessive lateral rotation.
- Posterior pelvis and thigh to facilitate gluteus maximus function.
- For persistent pelvic rotation, e.g. toward the right: rotation strapping to reduce right hip medial rotation and wide oblique abdominal strapping to facilitate the right external oblique.
- Knee, anterior split straps to increase terminal swing knee extension.
- Knee to reduce lengthening (valgum) strain on the medial knee ligaments.
- Knee to reduce true varum strain on the lateral ligaments.
- Leg and knee, to reduce lateral leg unit rotation.
- Leg and knee to reduce medial leg rotation.

## **Gait Deviations and Balance Issues**

4. TheraTogs™ garments and strapping systems as an aide in reducing ataxic gait deviations, staggering, and to improve balance, mid-range control, stair climbing skill, ADLs. What are the influences of using the following combinations of TheraTogs components for one child with ataxia:
- Hipster only, applied as directed.
  - Hipster and Tank Top only, applied as directed.
  - Both garments plus straight straps to approximate the thoracic cage toward the pelvis, crossing the greater trochanters between distal interior thighs and anterior and posterior thorax.
  - Both garments plus 2 split straps applied to the lateral trunk and anterior and posterior thighs to compress the thorax - at the region of T-8 - onto the pelvis.
  - Both garments plus 2 large split straps applied to the anterior and posterior trunk – at the region of T-6 - and thighs, distal to the hip joints.

## **Radiologic Assessments**

5. Is there a normalizing influence of daily (or 5 days/week) use of a TheraTogs™ garment and strapping system on long bone geometry and/or thoracic or lower extremity joint alignment:
- q When the system is introduced
- between ages 6 and 12 months?
  - between ages 12 and 24 months?
  - between ages 24 and 36 months?
  - between ages 36 and 48 months?...etc.
- q What is the relationship between changes in radiologic findings and the child's gross motor functioning level?
- q If radiologic changes are observed after a designated period of TheraTogs wear, are they retained?

## **A few research questions that miss the point of the invention:**

**Do TheraTogs have universal, generalizable effects on function?** The variances among users are immeasurably vast. TheraTogs were designed to be customized by the clinician to meet the needs of the user as specifically and appropriately as possible.

**What is the optimum duration of TheraTogs wear?** This question is answered only by the user and his or her caretakers and clinicians. I've used them for 3 weeks to usher one infant from static standing and cruising into walking, and she was finished with them. Another infant showed no more gains in them after 7 months of wear. A teenage boy used them for 3 years, and has accomplished the postural goal, and no longer wears them. A girl with diplegia, age 6 and level I, wore them diligently for

4 years and unexpectedly normalized her femoral torsional alignment. Two sisters without CP but with several torsional and rotational LE malalignments - ages 4 and 6 years at the outset - have worn them for 11 months to date for modeling purposes only. They have both corrected all but one alignment feature each in that time, and have begun a weaning and monitoring process intended to maintain the gains.

**How does a large group of children with diplegic CP respond to the same strapping application?** TheraTogs were designed to replace and prolong the effects of the hands of the therapist as they cue the child to make particular postural and movement corrections. Unless all members of the study group exhibit identical musculoskeletal and sensory perceptual features, an appropriate TheraTogs application would be different for each subject.

**How well do TheraTogs work for children with paralysis (myelodysplasia, spinal cord injury?)**

TheraTogs are made of elasticized fabric. Children without sensation or any active movement would have to depend on a fabric orthosis for passive support. TheraTogs were not developed for this problem.