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**Jefferson**  
Thomas Jefferson University  
HOME OF SIDNEY KIMMEL MEDICAL COLLEGE

## Revolutionizing AI Health - Stable Core Technologies

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**Stable Core Technologies**



## **Vision**

Our goal is to help you feel empowered and live with greater freedom as you activate your full potential no matter what physical challenge you may be facing

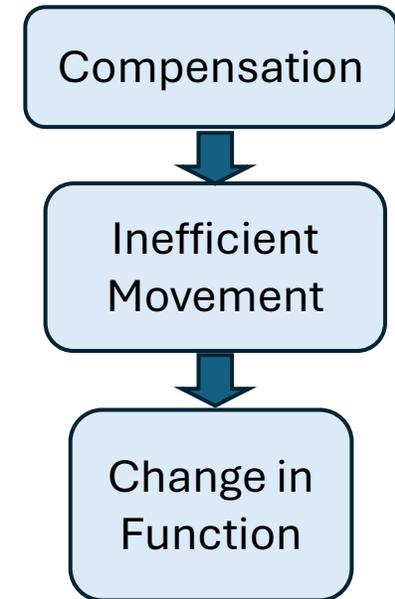
## **Executive Summary**

- Stable Core Technologies (SCT) has developed a clinically proven, patent-pending, customizable shirt that uses our high-performance textiles and dynamic fit to change directional instabilities about the trunk
- This enables the user to experience instant core stability and changes in function in the following populations:
  - Older adults facing challenges with balance, mobility and are increasingly at risk for falls
  - Patients with orthopedic dysfunction
  - Athletes aiming to enhance performance and recover from injury
  - Patients with neurologic conditions such as Multiple Sclerosis, Parkinson's Disease, TBI, and stroke
- SCT has a Total Accessible Market of over 140 million Adults in the U.S.

# Problem: Aging and Injuries Lead to Compensation

## Inefficient Movement Causes Changes in Function

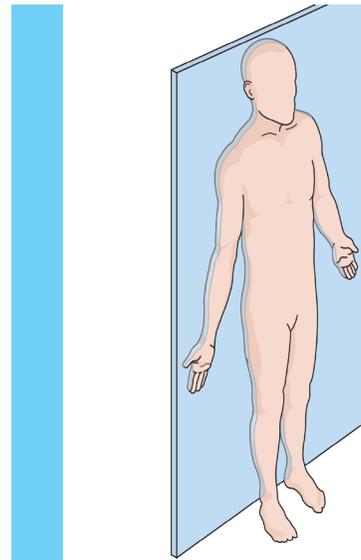
- As we age, recover from injury, or manage chronic conditions, our bodies become inefficient and develop compensatory movement patterns that become memorized
- These compensations lead to decreased efficiency, stability, and general limitations in physical function
- Existing solutions:
  - Take months of rehabilitation
  - Expensive
  - Often fail to address the root cause of the issues



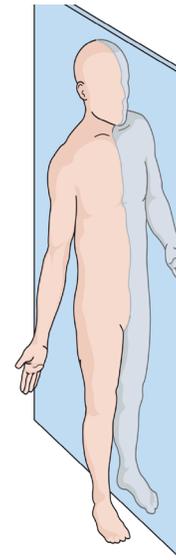
# The SCT Solution: Identify and Modify Compensations by Application of our Novel Wearable Technology

## Step 1: Identify Rotational and Directional Instabilities at the Trunk in all Cardinal Planes

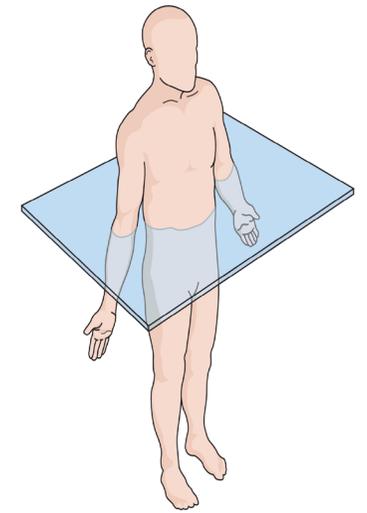
- **Rotational Instabilities** affect the user's core strength
- **Directional Asymmetries** affect automatic postural control reactions identified by perturbation testing



*Frontal (coronal) plane*



*Sagittal plane*



*Transverse (horizontal) plane*

## Step 2: Modify Imbalance Found at the Trunk By Applying Strategically placed Somatosensory Cue

Targeted-Sensory Inputs (TSI) are placed inside of the shirt in specific regions identified by our testing



The TSI “wakes up” slow inefficient pathways, and causes a change in motor firing patterns



This clinically proven process is called Balanced Based Torso Weighting (BBTW)

Cue to address identified imbalance



# Somatosensory Cues Change Motor Responses at the Trunk Through Anatomic Muscular Slings

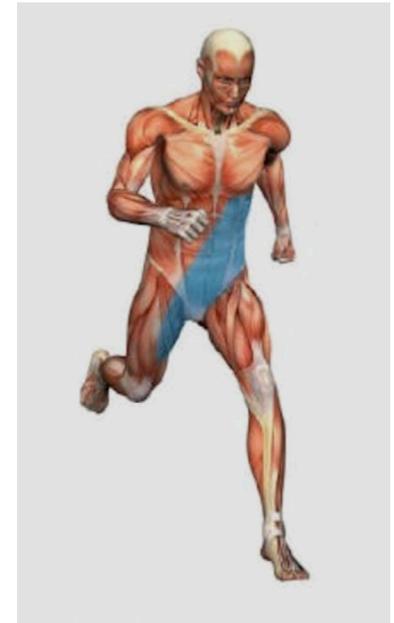
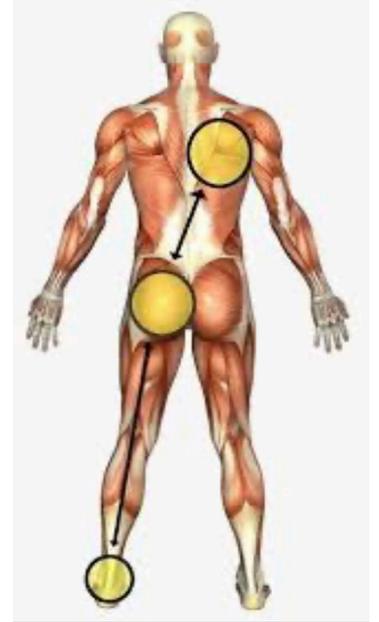
Slings are interconnected groups of muscle, fascia, and ligaments that allow the upper body to communicate with the lower body



Targeted regions inside of the shirt receive TSI and amplify information traveling through the slings

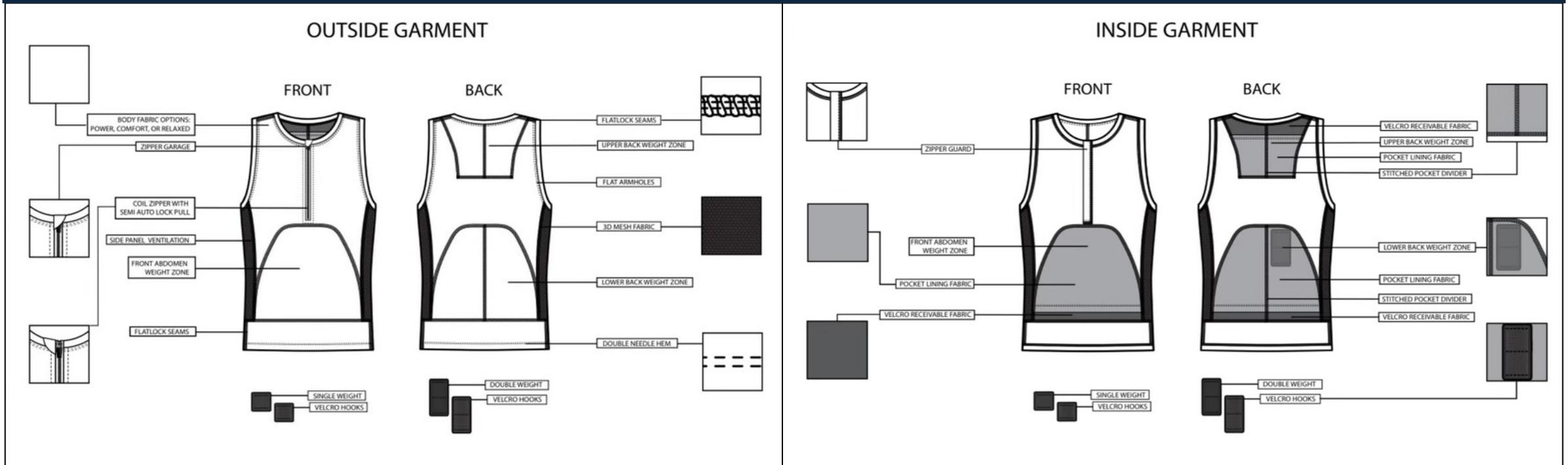
This allows:

- Proper transfer of forces from the trunk to extremities
- Improved ability for the user to maintain their center of gravity over their base of support
- Enhanced symmetry and directional control



# Patent Pending-Elite Performance Shirt

## Drives Outcomes with Advanced Materials and Construction Technology



### Lightweight

Designed to be worn for extended periods during daily activities, workouts, or all day as needed

### Breathable

The materials chosen for construction is moisture-wicking help regulate heat. Venting panels significantly improve the product comfort

### Customizable

Each shirt has designed sewn strategic positions inside the apparel –with 5-way stretch/recovery micro-pile receivable textile attachment of targeted sensory inputs

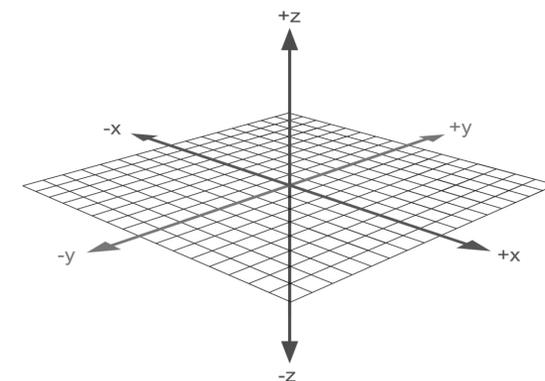
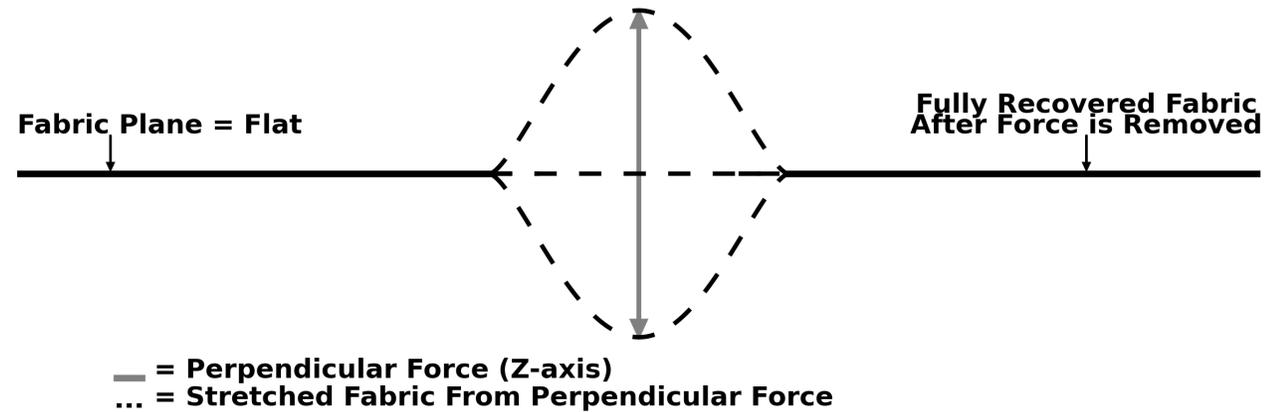
# Textile + Material Innovation Drives Efficacy and Dynamic User-Experience

5-Way stretch and recovery  
base performance fabric-  
strength, power, and on-body  
controlled comfort and function

5-Way stretch and recovery  
micro-pile receivable textile  
located in targeted zones inside  
of the shirt, holds the sensory  
inputs in the precise location

Empathetic design and fit to  
maximize function, performance,  
and efficacy of each targeted  
user population

## 5-Directional Stretch and Recovery



## 2- Product Lines

Meeting the Challenges  
of our Client's Needs  
with Efficacy

 Athletes  Medical

### Power

 Designed for the high-impact athlete or for those who need compression control. Stabilizes the input in the targeted zone for high-impact sports that involve running/jumping. The shirt secures the weight/stimulus under stress/strain without deforming the fabric, ensuring efficacy.

### Relaxed

 This line is comfortable to wear all day and still provides the changes in function and balance that our users have come to expect. This line is made of our least restrictive material and also comes in a full-zip version. This line is perfect for wearing to work or long walks with loved ones. The initial run of shirts were made with the relaxed fabric.

(Dots represent fits most)

# The Importance of Motor Learning

## **Short Term Memory**

As the user wears the shirt, the sensory cue optimizes core firing patterns. The user then experiences observable changes in stability, function, and ability immediately after the shirt is applied

## **Long Term Memory**

Temporary changes become permanent with continued use. Many users can decrease or eliminate the cue required as their body re-learns efficient movement patterns

***Comfort, wearability, and fit are essential for a prolonged active user experience***

# SCT Shirt Uses Research Driven Technology That Has Been Proven to have a Positive Effective on Stability and Function in the Following Populations

## Older Adults at Risk for Falls:

Noah S, Gibson-Horn C, Vincenzo JL. Four months of wearing a balance orthotic improves measures of balance and mobility among a cohort of community-living older adults. *Journal of Geriatric Physical Therapy*. 2019;42(4):216-223. doi:10.1519/jpt.00174 <https://pubmed.ncbi.nlm.nih.gov/29351127/>

Vincenzo JL, Gibson-Horn C, Gray M. Short-term effect of BalanceWear therapy on mobility in older adults with mobility limitations. *J Geriatr Phys Ther*. 2017;40(4):175-182. doi:10.1519/jpt.0094 <https://pubmed.ncbi.nlm.nih.gov/27341326/>

Vincenzo JL, Gibson-Horn C, Gray M. Short-Term Effect of BalanceWear Therapy on Mobility in Older Adults With Mobility Limitations. *J Geriatr Phys Ther*. 2016

# Randomized Control Study: Effect on Mobility in Older Adults at Risk For Falls in Assisted Living using BBTW Technology

## Results after 5 days

- 30 subjects, double-blind study, mean age 86
- Subjects wore the technology for 2 hours 2 times per day for 5 days
- Subjects were not given balance exercise
- Pre-test Functional Gait Assessment, 5 times sit to stand (FTSTS), Times up and go (TUG), Short Physical Performance Battery (SPPB)
- results showed decreased sway, and improved gait metrics by day 5

## Results after 2 Months

- 24 subjects, mean age 87
- Wore the technology 2 hours twice a day for 4 months
- Statistically significant changes on SPPB with test condition increasing 1.3 pts improving past fall risk cut off
- Patients in the test condition walked faster and had marked decreased risk of falls (increase .09m/s) improving beyond falls cut off
- FTSTS improved 7.4 sec, TUG improved 3.5 sec
- Control Group had no change

# SCT Shirt Uses Research Driven Technology That Has Been Proven to have a Positive Effective on Stability and Function in the Following Populations

## Multiple Sclerosis

Horn KK, Allen DD, Gibson-Horn C, Widener GL. Effects of torso-weighting on standing balance and falls during the sensory organization test in people with multiple sclerosis. *Int J of MS Care*. 2018;20(2):68-75. doi:10.7224/1537-2073.2015-090 <https://pubmed.ncbi.nlm.nih.gov/29681777/>

Gorgas A-M, Widener GL, Gibson-Horn C, Allen DD. Gait changes with balance-based torso-weighting in people with multiple sclerosis. *Physiother Res Int*. 2014;20(1):45-53. doi:10.1002/pri.1595 <https://pubmed.ncbi.nlm.nih.gov/24930996/>

Hunt CM, Widener G, Allen DD. Variability in postural control with and without balance-based torso-weighting in people with multiple sclerosis and healthy controls. *Phys Ther*. 2014;94(10):1489-1498. doi:10.2522/ptj.20130288 <https://pubmed.ncbi.nlm.nih.gov/24903118/>

Hunt CM, Widener G, Allen DD. Variability in postural control with and without balance-based torso-weighting in people with multiple sclerosis and healthy controls. *Phys Ther*. 2014;94(10):1489-1498. doi:10.2522/ptj.20130288 <https://pubmed.ncbi.nlm.nih.gov/24903118/>

Widener GL, Allen DD, Gibson-Horn C. Randomized clinical trial of balance-based torso weighting for improving upright mobility in people with multiple sclerosis. *Neurorehabil Neural Repair*. 2009;23(8):784-791. doi:10.1177/1545968309336146 <https://pubmed.ncbi.nlm.nih.gov/19470807/>

# Multiple Sclerosis Case Study Shows Significant Improvement



Stable Core Technologies

<https://youtu.be/D-Nley572lc>

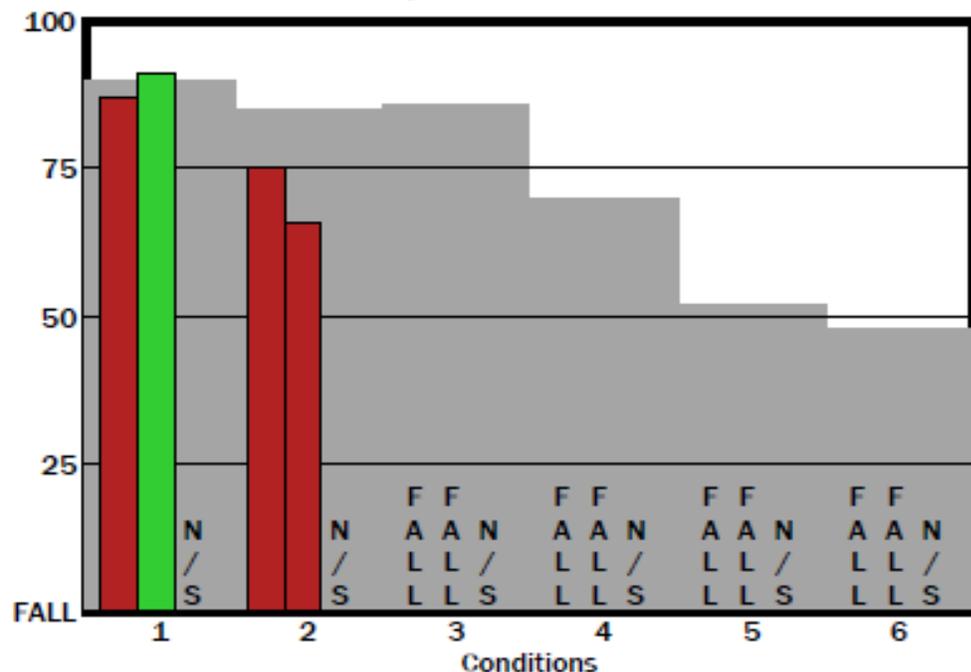
# Multiple Sclerosis Case Study Shows Significant Improvement SOT in One Day

(Case Study Performed by Future CEO of SCT on Himself 10 years Prior to Company Inception)

- Andrew Lesher 2012, Same Day Sensory Organization Test

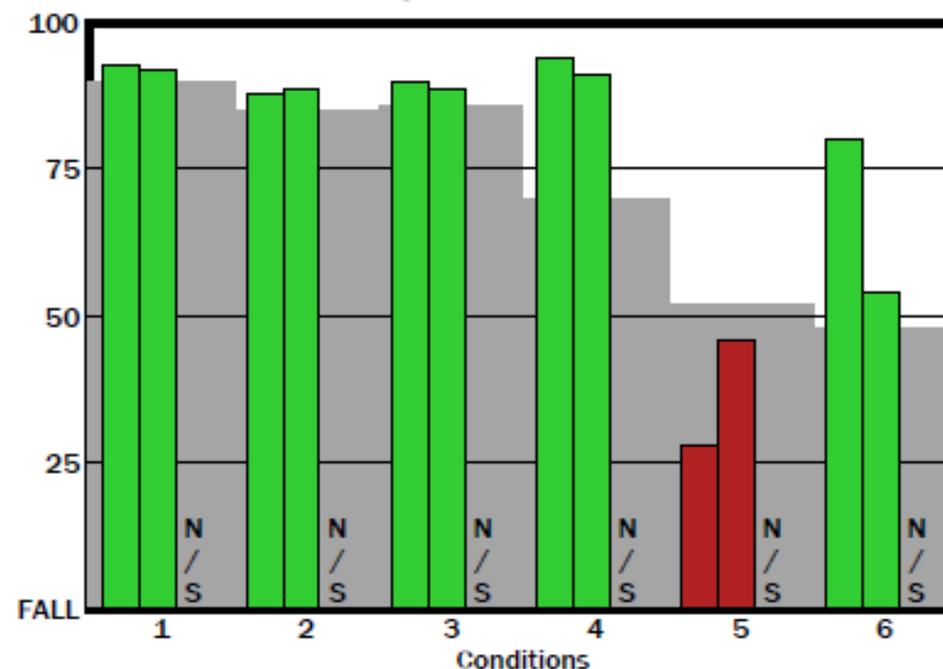
## Pre-Shirt Test

Equilibrium Score



## Post-Shirt Test

Equilibrium Score



- Larger study N>50 showed increased gait speed and decreased trunk sway in patients with MS and healthy controls shows significant improvement with sensory augmentation to the trunk (N>50) (Horn)

# SCT Shirt Uses a Research Driven Technology That Has Been Proven to have a Positive Effective on Stability and Function in the Following Populations

## Neuropathy

Askari, Hasan. Immediate and significant reduction in fall risk in patients with peripheral neuropathy, treated with BalanceWear® Therapy: A Case Series. AAN Washington DC., April 2015.

## Stroke

Physical Therapy Association National Convention – Podium Presentation: Balanced Based Torso-Weighting® Demonstrates Immediate Improvement in a Woman With a Parietal CVA;

Duborow, C. Stroke outcomes and benefits of BalanceWear Therapy. Pennsylvania Neuroscience. October 2015.

## Parkinson's

Lazaro R, Tanasescu M, Widener G, Burke-Doe A. The Immediate Effects of Torso Weighting on Balance and Functional Measures of People with Parkinson's Disease. World Confederation of Physical Therapy WCPT) Scientific Meeting, Amsterdam, Netherlands, June 2011

## TBI

Askari et al. Investigating the Effects of Balance-based Torso-weighting on Improving Balance and Reducing Falls in Post Concussion Syndrome Patients. Poster Presentation at: AAN Sports Concussion Conference 2015; Denver, Colorado

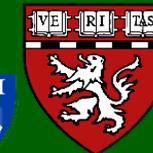
## Cerebellar Ataxia:

Widener GL, Conley N, Whiteford S, et al. Changes in standing stability with balance-based torso-weighting with cerebellar ataxia: A pilot study. *Physiother Res Int.* 2020;25(1):e1814. doi:10.1002/pri.1814 <https://pubmed.ncbi.nlm.nih.gov/31749254/>

Gibson-Horn C. Balance-based torso-weighting in a patient with ataxia and multiple sclerosis: a case report. *J Neurol Phys Ther.* 2008;32(3):139-146. doi:10.1097/NPT.0b013e318185558f <https://pubmed.ncbi.nlm.nih.gov/18978670/>



# Investigating the effects of BBTW on improving balance and reducing falls in Post Concussion Syndrome patients



Hasan Askari, MD\*, Christine Tilburg PT, Robert Burger, PT, Mohammad Salajegheh, MD

## Abstract

**OBJECTIVE:** Investigating the effects of BalanceWear® Therapy in restoring balance, decreasing falls and return to work in post-concussion patients.

**BACKGROUND:** Falls are a major debilitating complication in patients with Post Concussion Syndrome (PCS). Conventional treatment, provided over many weeks, is associated with modest recovery. Treatment using Balance Based Torso-weighting® (BBTW) and BalanceWear® Therapy (BWT) has been previously shown to improve balance and lead to decreased falls in patients with Multiple Sclerosis and peripheral neuropathy.

**DESIGN/METHODS:** 7 PCS patients, 1 male and 6 females, ages 28-77 (mean 49.9) years with c/o imbalance over 4-72 (mean 17.8) months were assessed. The diagnosis of PCS was made based on history and exam. All patients had normal MRI of brain and cervical spine. Gait abnormalities, imbalance and fall tendencies were determined prospectively using Activities-specific Balance Confidence (ABC) scale and Timed up and Go (TUG), before and after BWT. Number of falls and ability to return to work or routine activities, 4 months before and 4 months after BWT were recorded. Relevant paired t-tests were performed with alpha set at 0.05.

**RESULTS:** Various measurements of balance and gait demonstrated statistically immediate and significant improvement post BalanceWear® therapy (BWT), compared with pre-BWT, including ABC scale (33.2 compared with 82.1 and 82.7 at 1 and 4 months p<0.02) and TUG (11.26 compared with 7.7 pre and immediately post BWT p<0.02). Number of falls decreased from a mean 49.6 to 0.71 (p<0.02). Six (6) out of 7 patients returned to work at the end of the 4 months. Four (4) out of seven (7) patients did not need BWT due to balance-normalization, after 4 months.

**CONCLUSIONS:** (1) BWT expedites balance-restoration in patients with post-concussion syndrome and, (2) BWT leads to immediate and significant improvement in balance confidence and fall reduction in patients with post-concussion syndrome.

## Background

Post Concussion Syndrome (PCS) is a major cause of imbalance and falls.

Balance-Based Torso-Weighting® (BBTW) is a new treatment for balance and gait impairment. BBTW is associated with improving balance and gait in several studies in patients with MS<sup>3,4,5</sup> and peripheral neuropathy<sup>6</sup>. During BBTW, patient-specific directional static and dynamic imbalance is identified in all planes of movement while the patient stands in the Romberg position. Perturbations and rotations are tested and rated from no loss [0] to loss in all direction equaling a fall [48]. BalanceWear® Therapy (BWT) involves obtaining a customized balance orthosis the patient wears with strategically placed Targeted Somatosensory Inputs (TSIs) in the form of small weights titrated to improve three dimensional control of balance in the Romberg position and during ambulation.

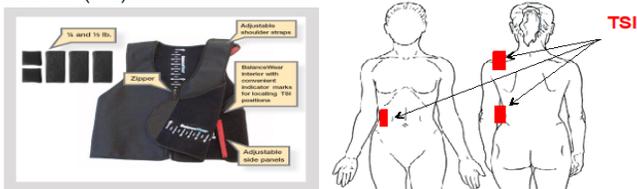
This case report series is the first to demonstrate the use and beneficial impact of BalanceWear® Therapy (BWT) causing a significant and immediate reduction of fall risk in patients with short, intermediate and long-standing diagnosis of PCS, unsteady gait, high fall risk and frequent, near daily, falls.

## Methods

### Balance-Based Torso-Weighting Protocol

Patient stood with their feet in the Romberg position

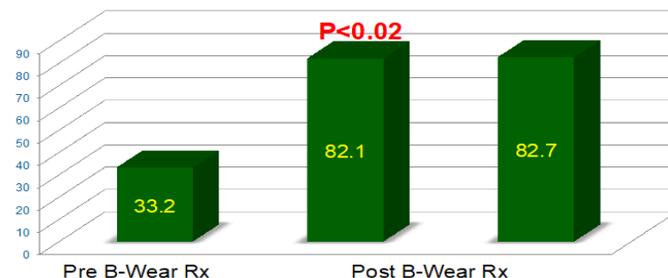
- Observation of body sway
- Resistive Rotations and Perturbations applied at upper and lower torso
  - Anterior
  - Posterior
  - Lateral
- Small Weighted ESDs were applied strategically in BalanceWear to improve the loss of balance and alleviate the rotational asymmetry found in the BBTW (3-5)



## Results

### ABC Fall Scale

#### Instantaneous Improvement (Decrease) in Fall Risk



## References

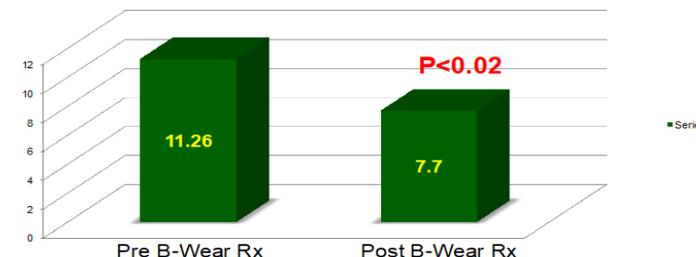
1. Richardson JK, Hurvitz EA. Peripheral Neuropathy: A True Risk Factor for Falls (1995) J Gerontol A Biol Sci Med Sci (1995) 50A (4): M211-M215
2. Shumway-Cook A, Horak FB. Assessing the influence of sensory interaction of balance. Suggestion from the field (1986). Phys Ther 66 (10):1548-1550.
3. Gorgas AM, Widener GL, Gibson-Horn C, Allen DD. Gait changes with balance-based torso-weighting in people with multiple sclerosis (2015). Physiother Res Int 20(1):45-53.
4. Hunt CM, Widener G, Allen DD. Variability in postural control with and without balance-based torso-weighting in people with multiple sclerosis and healthy controls (2014). Phys Ther 94(10):1489-1498.
5. Widener GL, Allen DD, Gibson-Horn C. Randomized clinical trial of balance-based torso weighting for improving upright mobility in people with multiple sclerosis (2009). Neurorehabil Neural Repair 23(8):784-794.
6. Askari H et al. Balance-Based Torso-Weighting (BBTW): A Novel therapy to prevent falls in patients with peripheral neuropathy. Abstract at AAN annual meeting 2015.

**Nothing to Disclose**

©Hasan Askari, MD – PIN – AAN 2015

## Results

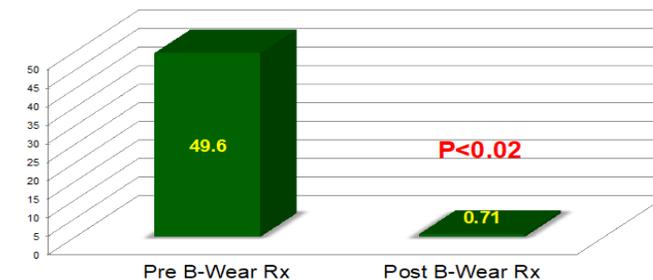
### Instantaneous Improvement in TUG Scores Decrease Fall Risk



Pts.	Gender (M/F)	Age (years)	Falls/day	# of falls (Mean)
7	1/6	28-77 Mean age 49.9	1 – 3	49.6/pre – 0.71/post

### Demographics for PCS patients

#### Decrease in number of Falls

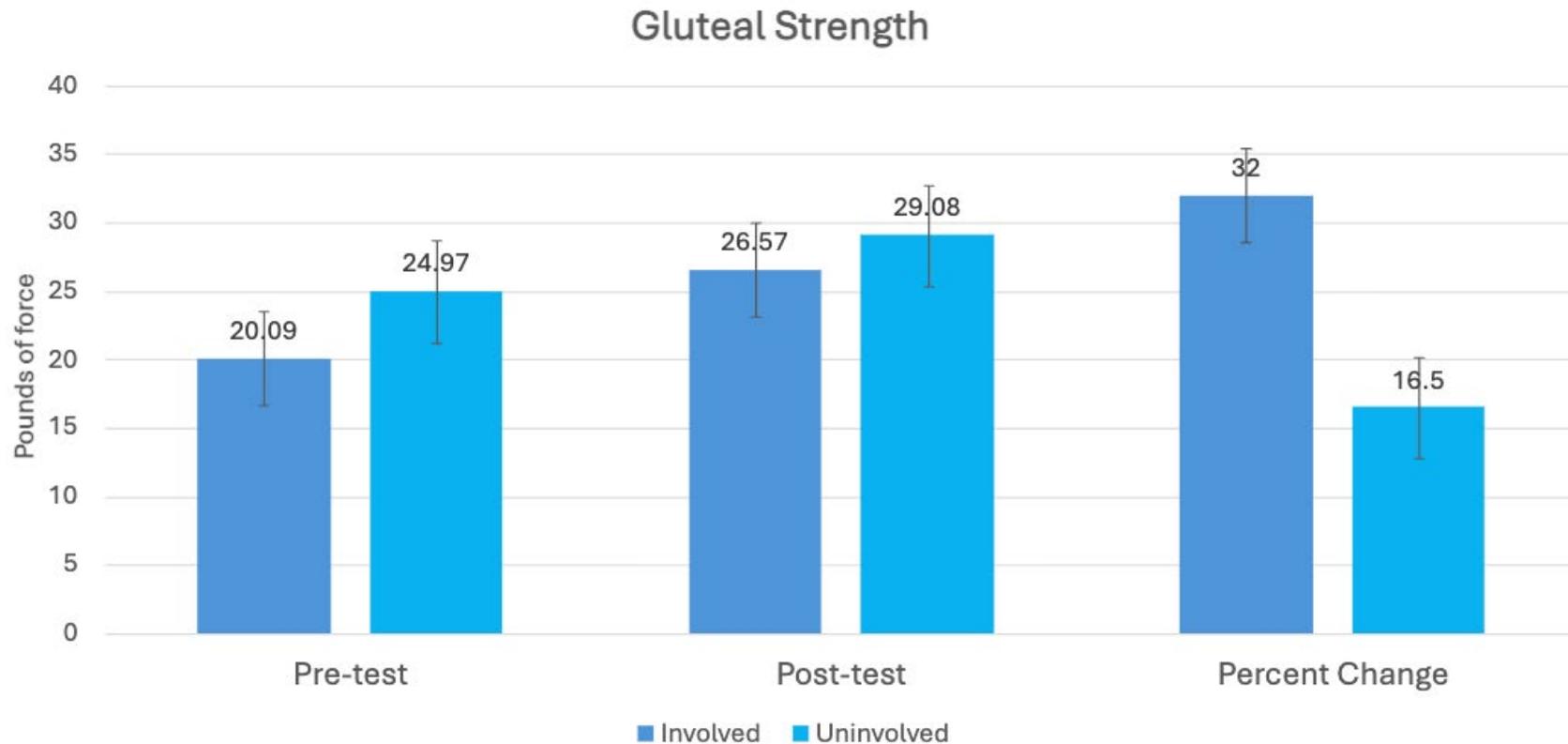


## Conclusions

BalanceWear® Therapy was **instantaneously successful** in decreasing fall risk, improving balance and ambulation in all patients with post concussion syndrome (PCS) as noted by highly significant improvement in ABC Fall scale, TUG scores and a marked decline in actual number of falls.

Studies on long term impact of BalanceWear® therapy are needed for better understanding.

# Same Day Change Gluteal Strength With Use of Shirt in 35 Patients with Low Back/Hip Pain Using a Force Dynamometer



**Involved side** (M = 36.2%, SD = 18.0, SE 4.37)

**Uninvolved side** (M = 19.3%, SD 16.6, SE 4.15)

$p < .001$ , Cohen's  $d = 1.15$ .

Note: P value less than .05 is significant, Cohen's  $d$  over .8 is considered a large effect size.

# Sports Performance Studies Underway

Change in Center of Pressure data showing less sway in D1 baseball at Penn State using Shirt vs no Shirt  
Using Vald force plate

Long Term Study on effect of shirt on Swing Decision in Baseball

Effect of Bat Speed/ Exit velocity pre/post shirt at eastern University D3 softball (n24) using PocketRadar tech

Effect of Bat Speed/ Exit velocity pre/post shirt at eastern University D3 softball (n24) using PocketRadar tech

Effect of change of club/ ball speed/ smash factor using Foresight GC quad Golf Simulation in D2 golf (n14)

Vertical Jump study D3 bball/ football force plate

# Future Opportunities: Embedded Sensors Enhance and Create the Change While Allowing Greater Market Penetration

Sensors relay real time data to the client regarding postural sway and their ability to maintain their center of gravity over their base of support. AI assistant will teach user how to weight the shirt

The sensors are programable so that they can emit a somatosensory cue in the targeted zone causing an immediate change in function. The cue can be used alone, or in combination with other cues

The user's family, coach, or care team member can view the data to ensure efficacy in the given use case. Alerts can be sent to the practitioner or family if risk of falls increases

*Unlike other products we will have the first wearable product that helps prevent a fall, not just alert EMS that a fall has occurred*

# Conclusion

- SCT has developed a clinically proven, patent-pending, customizable shirt that uses high-performance textiles and dynamic fit to change directional instabilities about the trunk
- This enables the user to experience instant core stability and changes in function in the following populations:
  - Older adults facing challenges with balance, mobility and are increasingly at risk for falls
  - Patients with orthopedic dysfunction
  - Athletes aiming to enhance performance and recover from injury
  - Patients with neurologic conditions such as Multiple Sclerosis, Parkinson's Disease, TBI, and stroke
- SCT has a Total Accessible Market of over 140 million Adults in the U.S. SCT will rely on the use of AI application integrated into its sensor technology to enhance its evaluation, treatment, and training protocols. AI will be crucial to to SCT to allow for proper market penetration.
- Through the use of AI, SCT will revolutionize the rehabilitative and sports performance industries

# CONTACTS

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