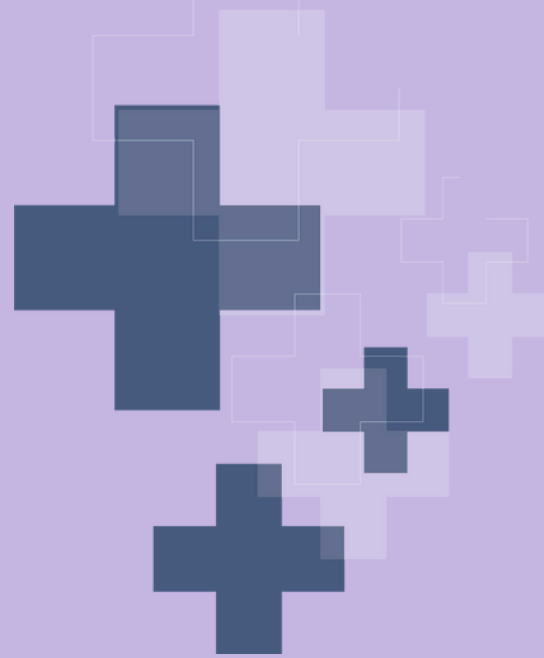


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# CLINICAL GUIDE





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# USER MANUAL & TECHNICAL DOCUMENTATION



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# COMPANY OVERVIEW

Baliston is a global leader in **advanced movement analysis technology**, used by over **1,000 healthcare practitioners** worldwide and validated through the successful analysis and treatment of more than **120,000 patients**.

Our **AI-Powered Mobility Scan Technology** empowers healthcare professionals to perform precise mobility assessments and monitoring, delivering actionable insights that enhance patient care and outcomes.

## Our AI Mov-Scan Platform (MSP)

- How does it work ?

AI Motion Library Engine  
Advanced analysis of biomechanical parameters

AI-Enhanced MovScan  
Smart Insoles  
Accurate real-world movement data capture

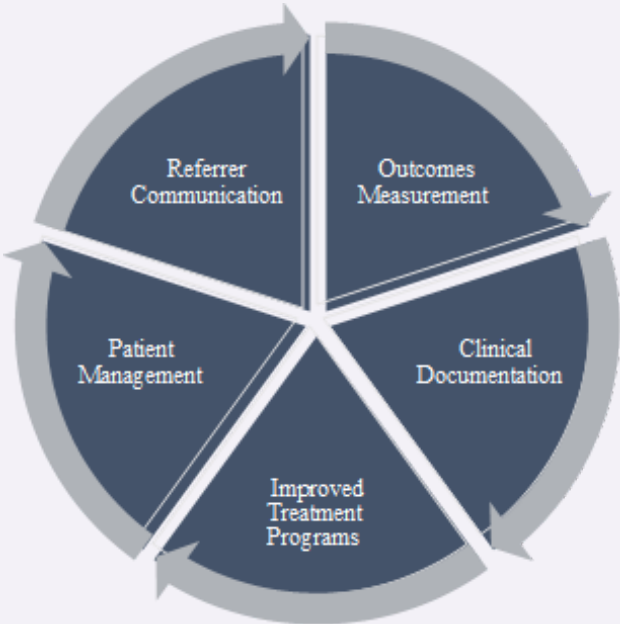


Cloud Integration  
Secure, seamless data storage and remote access

Clinician Interface  
Actionable insights to support better decision-making

# PRACTICAL APPLICATIONS

Improving Your Business & Clinical Outcomes with Measurable Validation



With Baliston Health Experience  
True Evidence- Based Practice



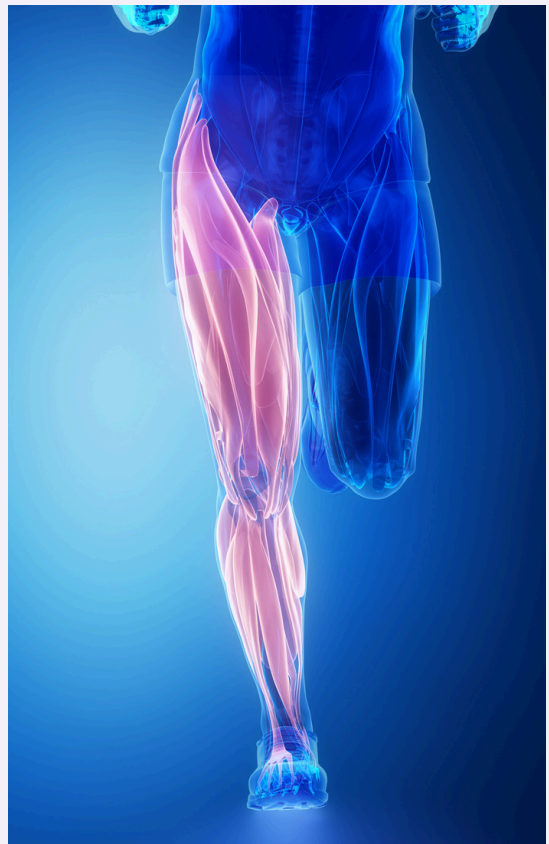


## PRACTICE APPLICATIONS

- Low Back Rehab
- Neurological Disorders
- Orthopedic Conditions
- Pre & Post-Surgical
- Sports Medicine
- Vestibular Rehab
- Work Health

## RECOMMENDED FOR

- Balance Testing
- Baseline Testing
- Postural Assessments
- Tracking Changes in Health



# INTRODUCTION

The U.S. has some of the highest healthcare spending in the world without the concomitant level of good health.

Early intervention has shown not only improved results with fewer later visits but overall lowered health care costs **(Rogerson 2010)**.

A key to reducing chronicity is early intervention. Early prediction of conditions that result in progression of more serious pathology is possible **(Wu 2022)**.

Early prediction could result in reduced joint replacements **(Tiulpin 2019)**.

Early intervention is associated with reduced joint replacement procedures **(Chen 2019)**.

Movement analysis shown for early detection of neurodegenerative disorders for intervention and QoL **(Dentamaro 2021)**.



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*DIRECTOR OF EDUCATION AT BALISTON*  
**D.C., PH.D.(ABD), C.S.C.S.**



## **Pathological Conditions that Influence Locomotion (aside from common lower extremity issues)**

- **Behavior/Cognition**
- **Neurodegenerative**
- **TBI**
- **Parkinson's**
- **Alzheimer's**
- **Neuropathy (MSK, metabolic)**
- **Stroke**
- **Cerebral palsy**
- **Obesity**
- **Osteoarthritis and chronic pain**
- **Knee**
- **Hip**
- **Spinal Pain**
- **Low back pain**
- **Neck pain**
- **Scoliosis (mod/severe)**



# CONSIDERATIONS

- **Spinal Pain** : **Low back** and **neck pain** is **number 1 cost** in US with **\$134.5 billion per year** (number 1 disability globally).
- **Knee Pain** : Knee pain can be a precursor to more serious OA, from biomechanical changes adapted during locomotion.
- **Knee ACL** : Previous ACL surgery can also be a precursor to future Knee OA (Smith et 2017).
- **Knee PFS** : Can lead to further disuse and additional comorbidities.
- **Hip Pain** : Pain and some of these metrics may also be prognostic factors in early identification and possible reduced progression (Tateuchi, 2019).
- **Plantar Fasciitis** : Even when pain has subsided, it is important to evaluate for causative factors, such as abnormal mechanics to include excessive foot pronation.
- **Concussion** : Especially look for abnormalities on side-to-side variations.
- **Falls** : In 2015, the total medical costs for falls totaled more than \$50 billion. Medicare and Medicaid shouldered 75% of these costs. Overall medical spending for fatal falls was estimated to be \$754 million.

# LIST OF USE CASES

- **Low Back Pain**
- **Chronic Low Back Pain**
- **Knee Osteoarthritis**
- **Knee ACLs**
- **Knee ACL Management**
- **Knee Patellofemoral Syndrome**
- **Hip Osteoarthritis**
- **Plantar Fasciitis**
- **Concussion/mTBI**
- **Neurodegenerative**
- **Fall Risk**
- **Fall Risk Profile**



# LOW BACK PAIN

## CONTEXT

- Low back pain is not actually about pain, it is about functionality. The main goal of the treatment plan is to improve **function**.
- The emphasis on pain can reduce effectiveness of the treatment and therefore success in key areas, such as patients' satisfaction, outcomes, value (cost: benefit), and influence internal and external referrals. Pain should be managed, and biopsychosocial interventions introduced with all conditions.

## BALISTON HEALTH APPLICATION

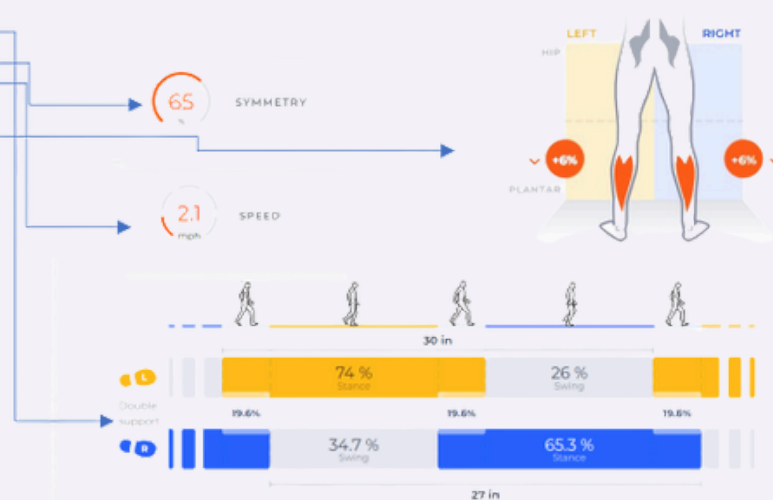
- Focuses on function, allows to deemphasize pain approach (typically patients leave when pain has subsided which results in readmission and greater cost) and reemphasizes interventional care.
- Resonates with patients' understanding of their actual problem and gives a visualization that results in their empowerment and greater compliance.
- Provides time and cost-effective assessment and informative method that spans the continuum of care.
- Allows for global insight of patient's overall health, often identifying other areas of dysfunction and converts them to a longer- term patient.
- Increases patient retention plus greater compliance and additional internal/external referrals leading to cost savings in overhead and overall increased revenues.

Low back pain is pain, muscle tension, or stiffness localized below the costal margin and above the inferior gluteal folds, with or without sciatica, and is defined as chronic when it persists for 12 weeks or more. Nonspecific low back pain is pain not attributed to a recognizable pathology (e.g., infection, tumor, osteoporosis, rheumatoid arthritis, fracture, inflammation). Chou, Clin Evd

- *Step and stride reduction, potentially asymmetrical*
- *Decreased walking velocity*
- *Hip strategies and core stability issues changes in propulsion rate*
- *Reduced variability in UE, trunk, and certain LE movement patterns (Chronic) can be opposite for acute.*

Additional Observations Needed:

- Trunk frontal and sagittal plane postures
- Trunk coordination strategies
- COM and extremity acceleration



# KNEE OSTEOARTHRITIS

## CONTEXT

- Main goal of treatment plan is to improve **function**.
- In the knee (and hip) OA presentation, it is also about getting to the root sooner than later and movement mechanics are highly impactful to doing this.
- The emphasis on pain is not consistent with function, as it is dysfunction that has caused the issue in many cases. Do manage knee pain, which may result in some functional improvement, but continued evaluation is necessary.

## BALISTON HEALTH APPLICATION

- Focuses on function, allows to deemphasize pain approach (typically patients leave when pain has subsided which results in readmission and greater cost) and reemphasizes interventional care.
- Resonates with patients' understanding of their actual problem and gives a visualization that results in their empowerment and greater compliance.
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Knee Osteoarthritis: Knee OA (and similar with hip) is a chronic degenerative condition that can be progressive deterioration of the articular components to the joint structure and subsequently function. Progressive degeneration often leads to eventual surgical intervention such as arthroplasty. Potential alterations that could be caught early on increased adduction moments and tibial rotation. Vincent et al 2012

- *Decreased symmetry, speed and changes in contact time in the walking profile*
- *Abnormal pattern in gait line, more shift to medial*
- *Pronation/Supination may produce increase pronation during foot flat, rapid supination on heel strike, increased standard deviation*
- *Foot progression angle may reveal increased external rotation*



# KNEE ACL

## CONTEXT

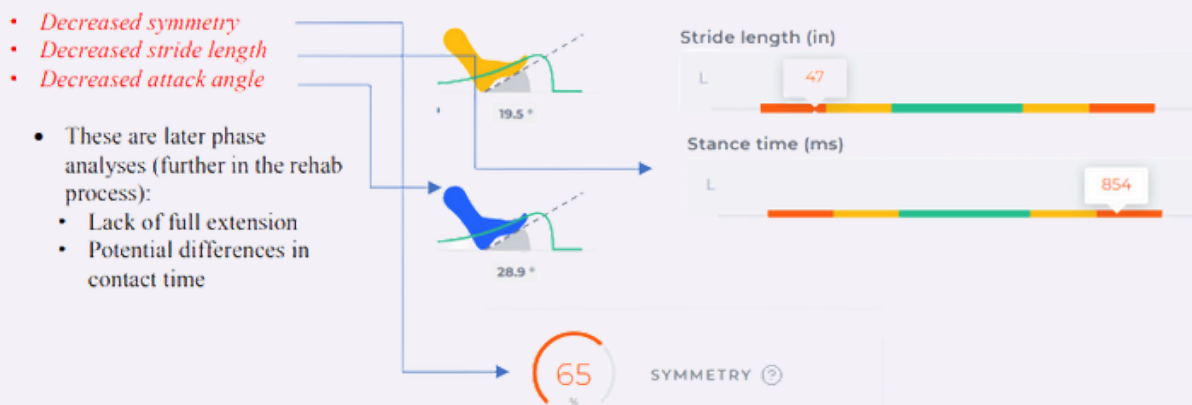
- Following surgical intervention or conservative management for ACL injury, return-to-sport criteria is important to determine readiness and prediction of future injury or re-injury.
- Main goal of treatment plan is to improve symmetry, however, it is important that the non-injured knee is an appropriate comparison.
- Prior to returning to sport, specific objective quantitative and qualitative criteria should be met. The length of time from surgery should not be the only consideration

## BALISTON HEALTH APPLICATION

- Prior to returning to sport, specific objective quantitative and qualitative criteria should be met. The time from surgery should not be the only consideration.
- Data improves compliance.
- Ease of functional, continued evaluation of progression



Knee ACL post-surgical management involves standardized notion of assessment and evaluation prior to return-to-play, however even prior evaluation through a progressive rehabilitation is crucial to success. Cavanaugh and Powers 2017



# KNEE PATELLOFEMORAL SYNDROME

## CONTEXT

- PFS is the most frequent cause of anterior knee pain, especially from an unknown trauma related perspective. Often there are weaknesses and tightness on opposing sides of the ligament/tendon resulting in abnormal tracking in the femoral condyle.
- Main goal of treatment plan is to identify and improve deficits, also aberrant movement patterns to create and support abnormal biomechanics.
- Prior to returning to sport, specific objective quantitative and qualitative criteria should be met. The time from surgery should not be the only consideration.

## BALISTON HEALTH APPLICATION

- In addition to providing quantifiable data in movement dysfunction related to the condition, additional factors involved in the etiology may be determined, such as increased pronation.
- Data improves compliance.
- Ease of functional continued evaluation of progression.



Knee PFS management involves improving balance in opposing structures to balance tracking of patella. It is also important to identify additional structural and biomechanical faulty patterns in locomotion. Arazpour et al 2016).

- *Decreased symmetry, speed and cadence*
- *Abnormal pattern in gait line, shorter time in toe off and lack of pronation (maximal calcaneal eversion) in toe off*
- *Decreased plantar flexion in propulsion rate favoring hip flexion on affected side*



# HIP OSTEOARTHRITIS

## CONTEXT

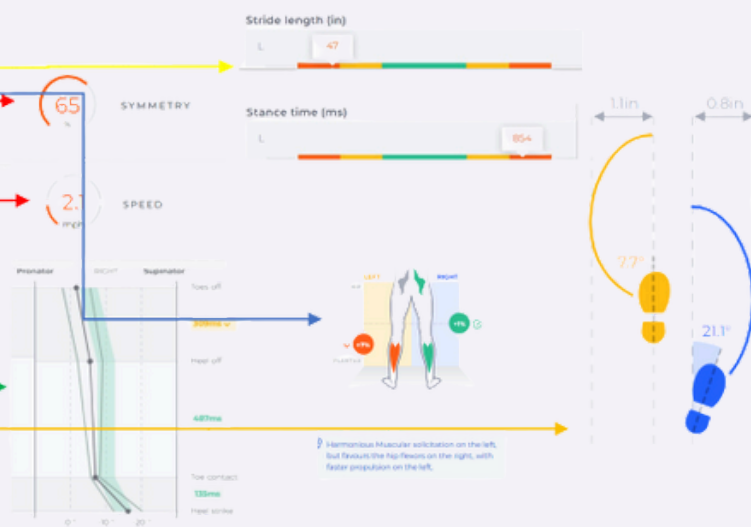
- Main goal of treatment plan is to improve **function**. However: In the hip (and knee) OA presentation, it is also about getting to the root sooner than later and movement mechanics are highly impactful.
- The emphasis on pain is not consistent with function, as it is dysfunction that has caused the issue in many cases. Do manage hip pain which may result in some functional improvement but continued evaluation is necessary

## BALISTON HEALTH APPLICATION

- Focuses on function, allows to deemphasize pain approach (patients leave when pain has subsided, which can result in readmission and greater cost) and reemphasizes the intervention.
- Resonates with patients' understanding of their actual problem and creates visualization that results in empowerment and compliance.
- Time and cost-effective assessment and informative method that spans the continuum of care.
- Allows for global insight of patient's overall health, often identifying other areas of dysfunction and converting to a longer term patient.
- Patient retention + compliance + internal/external referrals = overhead cost savings and increased revenue

Hip OA (and similar with knee) is a chronic degenerative condition that can be progressive deterioration of the articular components to the joint structure and subsequently function. Progressive degeneration often leads to eventual surgical intervention such as arthroplasty. Potential alterations that could be caught early on foot orientation and COM changes. (Kiss, 2010)

- *Decreased symmetry, speed and changes in contact time in the walking profile (especially heel strike to flat foot)*
- *Decreased balance in the propulsion rate, favoring plantar flexors on the affected side.*
- *Pronation/Supination may produce increase increased standard deviation throughout stance, especially the more progressive the condition*
- *Foot progression angle may reveal increased external rotation*



# PLANTAR FASCIITIS

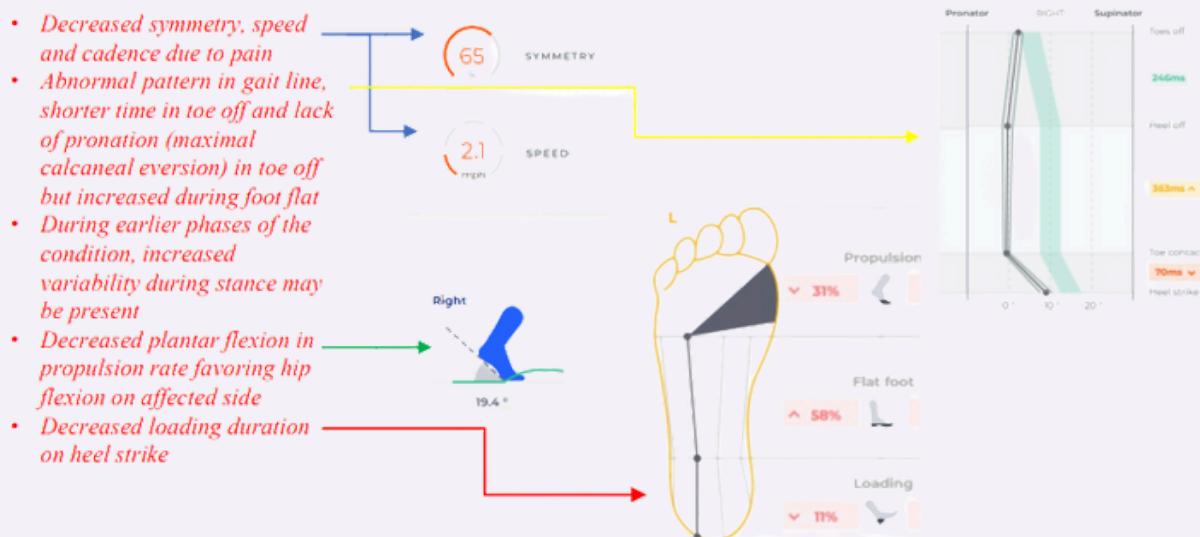
## CONTEXT

- Plantar fasciitis is a common foot pain issue found across many demographics but is often associated with overpronation/decreased medial arch height static or dynamic.
- The main goal of the treatment plan is to identify and improve deficits also aberrant movement patterns creating and supporting abnormal biomechanics; often inserts are recommended.
- Following pain management, it is important to identify causative factors

## BALISTON HEALTH APPLICATION

- In addition to providing quantifiable data in movement dysfunction related to the condition, additional factors involved in the etiology may be determined, such as increased pronation.
- Data improves compliance, and especially with a quantifiable source when recommending any inserts/orthoses
- Ease of functional, continued evaluation of progression
- Opportunity for additional Plantar Fasciitis product management recommendations such as night splints, sandals, slippers, & pain reducing ointment.

PF management sometimes involves debilitating pain on the plantar surface of the foot. Considered both an overuse in repetitive striking such as running, it can also be related to ankle range of motion in sagittal plane, first MTP joint ROM, and foot strength of the medial arch. (Bauer 2012)



# CONCUSSION/MTBI

## CONTEXT

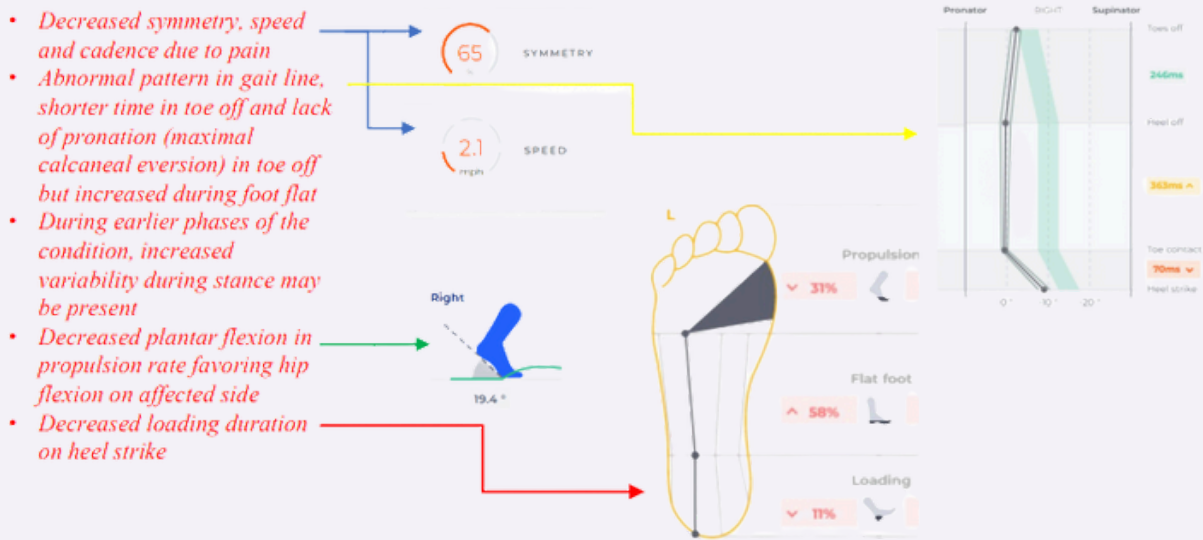
- Concussion is commonly associated with contact sports, non- contact speed, and height sports and falls.
- Due to the trauma on the brain, control centers can be impacted and influence aspects of motion and motor control mechanisms.

## BALISTON HEALTH APPLICATION

- In addition to provide quantifiable data in movement dysfunction related to the condition, additional factors involved in the etiology may be determine, such as walking speed and symmetry.
- Data improves compliance, and important to return to play and potential secondary impact syndrome can be fatal.
- Ease of functional continued evaluation of progression



Head injury management is important to determine appropriate return to activity. Using divided attention (an additional task to complete while walking) can create a more sensitive evaluation (Parker et al 2006). Parker et al (2008) determined that athletes in general walk differently than non-athletes and therefore baseline testing to determine actual deviations can be important.



# NEURODEGENERATIVE

## CONTEXT

- Neurodegenerative disorders affect millions and tend to have a progressive nature. Ehrhardt et al (2020) determined there are differences in spatiotemporal gait parameters in elderly with neurological and non-neurological conditions in fall risk.

## BALISTON HEALTH APPLICATION

- In addition to providing quantifiable data in movement dysfunction related to the condition, additional factors involved in the etiology may be determined, such as walking speed and symmetry.
- Data improves compliance, and important early detection of movement impairment.
- Ease of functional, continued evaluation of progression to plot and identify changes



Neurodegenerative conditions are progressive and may present with small, difficult to detect changes. Early detection can be used to slow the disease process and improve quality of life while potentially reducing risk of comorbidities such as falls.

- *Decreased symmetry, speed*
- *Increased stride duration with reduce length*
- *Cadence may sometimes present as increased or decreased relative to speed (compensatory).*
- *Pronosupination can help to identify variability in control strategies during stance*



# FALL RISK

## CONTEXT

- Falls are a sign of lower function, frailty, immobility and comorbidity health impairments.
- Falls can lead to a high rate loss of independence, further complications, and death.

## BALISTON HEALTH APPLICATION

- In addition to providing quantifiable data in movement dysfunction related to the condition, it is important to consider comorbidities and their potential impact on fall risk.
- Data improves compliance, and important early detection of movement impairment.
- Ease of functional, continued evaluation of progression to plot and identify changes.



Goldberg & Neptune (2007) determined of particular importance were the compensatory mechanisms provided by the plantar flexors, which were shown to be able to compensate for many musculoskeletal deficits, including diminished muscle strength in the hip and knee flexors and extensors and increased hip joint stiffness. Significant physical deficits associated with loss of strength and power. Loss of walking speed associated with cognitive loss and vice versa; result AND cause.

