The Future of Speed Training

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Overview

- Speed and Acceleration in Soccer
- Commonly Used Methods of Speed Training
- Treadmill Training: A New Method of Speed Training
- Our Research: *The Future* of Speed Training

A Bit About Me

- Not a chiropractor!
- Entrepreneur and Small Business Owner
- Professional Fitness Coach
- University Lecturer and Researcher
  - Exercise Physiology and Biomechanics
- Coach Educator

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A Bit About Soccer Fitness Inc.

- A soccer-specific strength and conditioning company located in Toronto, Ontario, Canada.

Our Principles of Training:

1. Athlete Assessment and Monitoring of Training	2. Functional, Sport-Specific Training	3. Science-Based Training
4. Customization and Periodization of Training	5. Athlete/Coach Education and Professional Development	6. Athlete Enjoyment

The Future of Speed Training

- Speed and Acceleration in Soccer

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Speed in Soccer

- Speed is a critical characteristic of performance in soccer

Speed in Soccer

- Speed is the ability to achieve maximum velocity, typically determined with the following equation:

stride length x stride frequency

Speed in Soccer

- Speed in soccer: includes maximum velocity, maximum acceleration (change in velocity), repeated sprint sequences, intermittent high intensity running activity

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Acceleration in Soccer

- Acceleration – or, short distance sprinting – is a key characteristic of speed in soccer:
  - "Top class" – professional – male players perform more high intensity running and sprinting than semi-professional players (Gissis et al., 2006)
  - Average number of sprints per game in male soccer: 11.2 ± 5.3 (Andrzeiwski et. al., 2013)
  - Average sprint distance in male soccer: 10-20m (Andrzeiwski et. al., 2013)

Acceleration in Soccer

- Acceleration – or, short distance sprinting – is a key characteristic of speed in soccer:
  - "Top class" – national team – female players perform more high intensity running and sprinting than "high level" – non-national team professional players (Mohr *et. al*., 2008)
  - Average number of sprints per game in elite female soccer: 26 (Krustrup *et. al*., 2005)
  - Average sprint distance in female soccer: 15.8m (Vescovi, 2012)

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Summary: Speed and Acceleration in Soccer

We know it is an important part of the game

∴ We must train to improve it

The Future of Speed Training

- Commonly Used Methods of Speed Training

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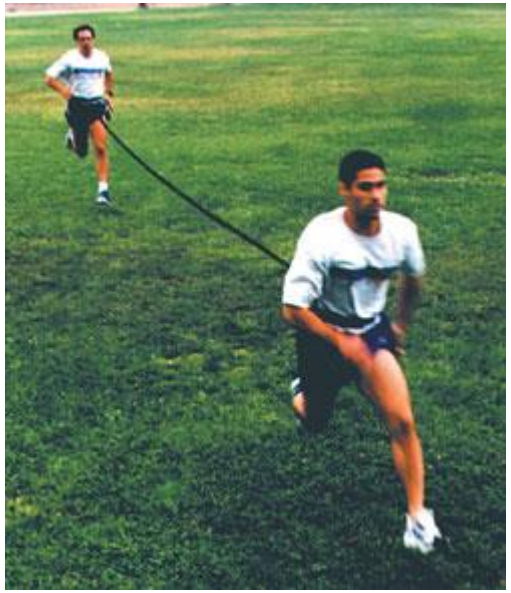
Commonly Used Methods

- To improve acceleration:

  Improve stride length – increase leg strength and leg power
  - Linear Sprints (Tonessen et al., 2011)
  - Resisted Sprints (Spinks *et. al.*, 2007)
  - Weighted Sleds (Morin et al., 2016)
  - Plyometrics (Chelly *et al.*, 2014)
  - Resistance training (80% 1RM); (Reilly, 2003)
  - Incline Running

Commonly Used Methods

- To improve acceleration:
  - Improve stride frequency- requires increasing speed of leg muscle contractions (also termed “over-speed training”)
    - Downhill running (Chen *et. al.*, 2007)
    - Assisted sprint training with elastic loading device (Upton, 2011)



BUT…What Do Coaches Want?

- Training that *works!*
  - Players run faster
  - Players jump higher
  - Players recover better

BUT…What Do Coaches Want?

- Training that *works*…
  - In the minimum amount of time
    (to maximise technical/tactical training time)
  - With minimal training load (to minimize injury risk)

The Future of Speed Training

- Treadmill Training: A New Method of Speed Training

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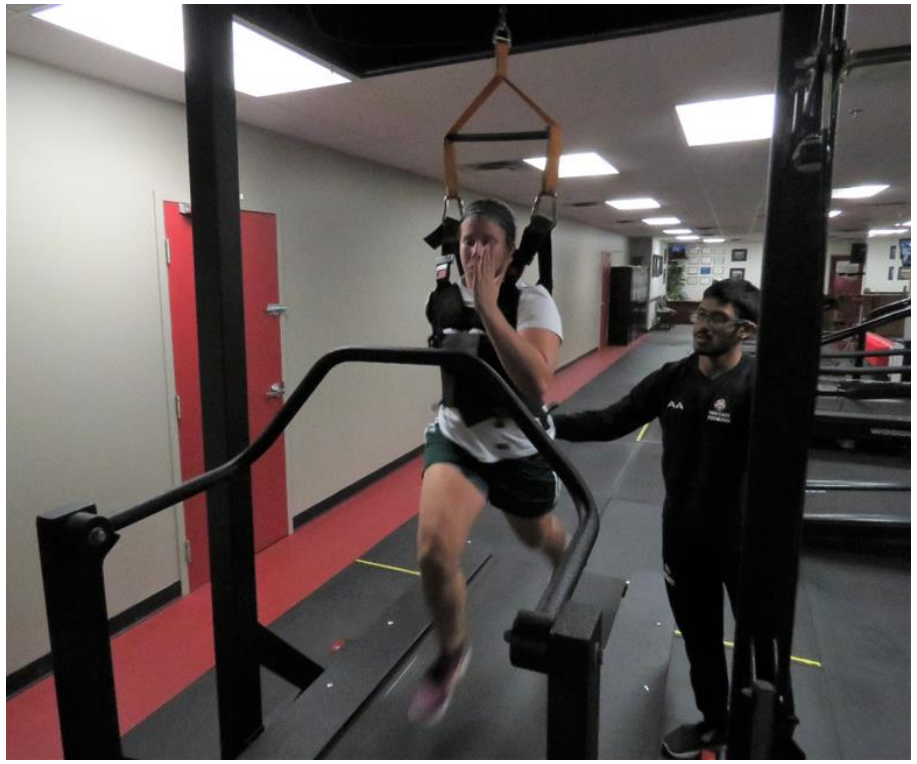
Why Treadmill Training?

- Treadmill training is a more effective method of speed training compared to conventionally used methods
  - It maximizes performance improvement in a minimal amount of time
  - It minimizes the risk of injury
  - It allows coaches to focus on coaching



High Speed Harnessed Treadmill Training

- Is an alternative method of assisted sprint training
- **Proven** to improve speed and acceleration in soccer players
  - Bucciarelli et al., 2017 (presented at 5th World Conference on Science and Soccer, Rennes, France)
  - Bucciarelli & Triumbari, 2018 (submitted to 9th World Congress on Science and Football, Melbourne, Australia)

High Speed Harnessed Treadmill Training

- How does it work?
  - Tuff Tread HS Elite High Speed Treadmill
    - Very high speeds (up to 30 Mph / 44 Kmph)
    - Un-weighting harness (10-120 lbs.)
    - Makes athletes “feel lighter” while running – they can run at speeds higher than what they could normally reach on the ground (up to 20-30% faster)

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High Speed Harnessed Treadmill Training

- What causes the improvement in speed/acceleration?
  - Our hypothesis: improvements in stride frequency occur by increasing the speed of leg muscle contraction when running (beyond that which can be achieved on the ground)

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High Speed Harnessed Treadmill Training

- Advantageous to elastic loading devices and/or downhill running, because:
  - Workloads can be customized to each individual athlete
  - Workloads can be more easily controlled, allowing coaches to focus on quality of movement

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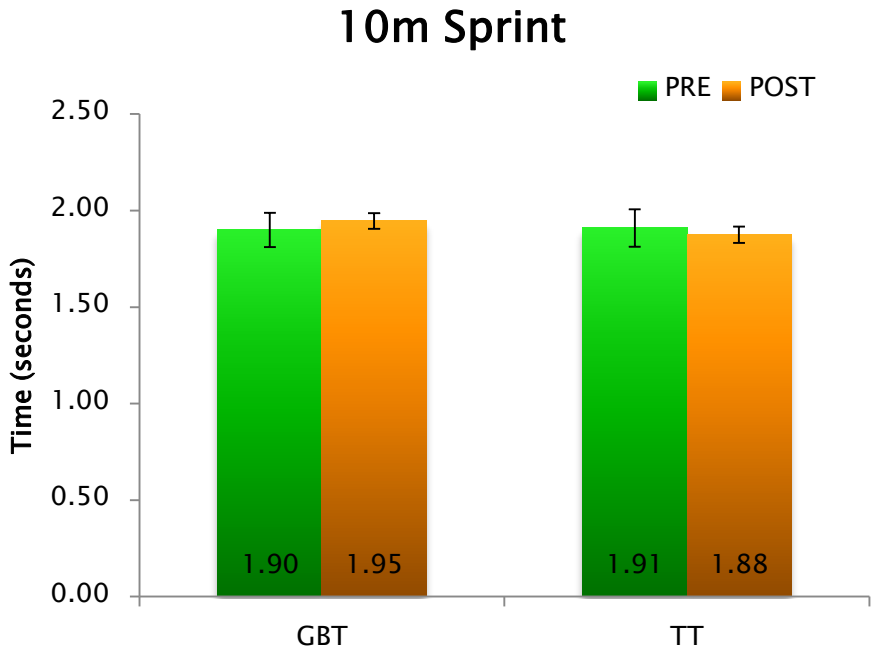
High Speed Harnessed Treadmill Training

- Has been shown to increase activation of specific muscles involved in sprinting, i.e. hamstrings and hip flexors (Higashihara, 2010)

High Speed Harnessed Treadmill Training

- PROVEN Benefits of High Speed Harnessed Treadmill Training

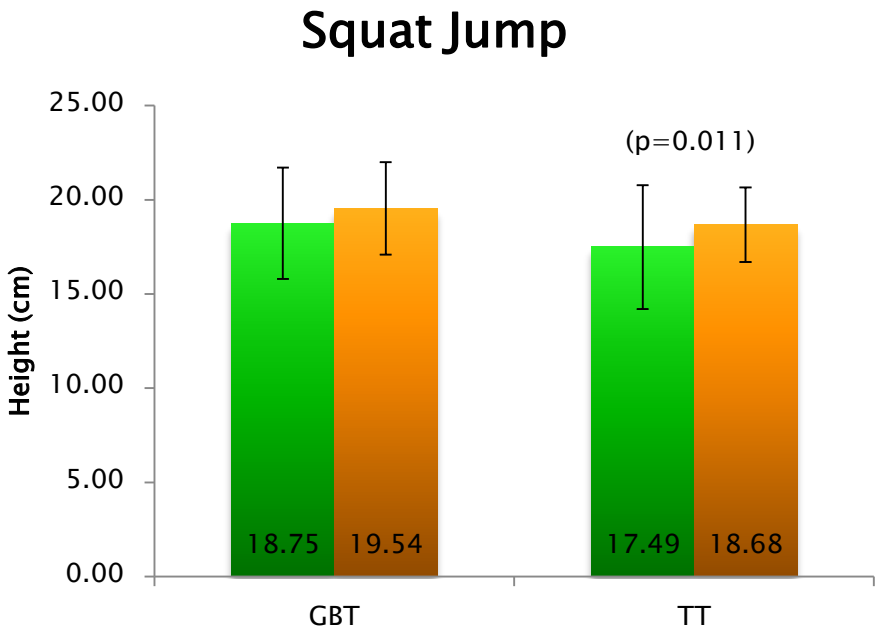
…Players run faster!



From Bucciarelli et al., 2017

High Speed Harnessed Treadmill Training

- PROVEN Benefits of High Speed Harnessed Treadmill Training
  …Players jump higher!



From Bucciarelli et al., 2017

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Self-Propelled, Resisted Treadmill Training

- Is an alternative method of resisted sprint training
- What causes improvements in speed/acceleration?
  - Our hypothesis: improvements in stride length occur by improving the ability of each leg to produce force

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Self-Propelled, Resisted Treadmill Training

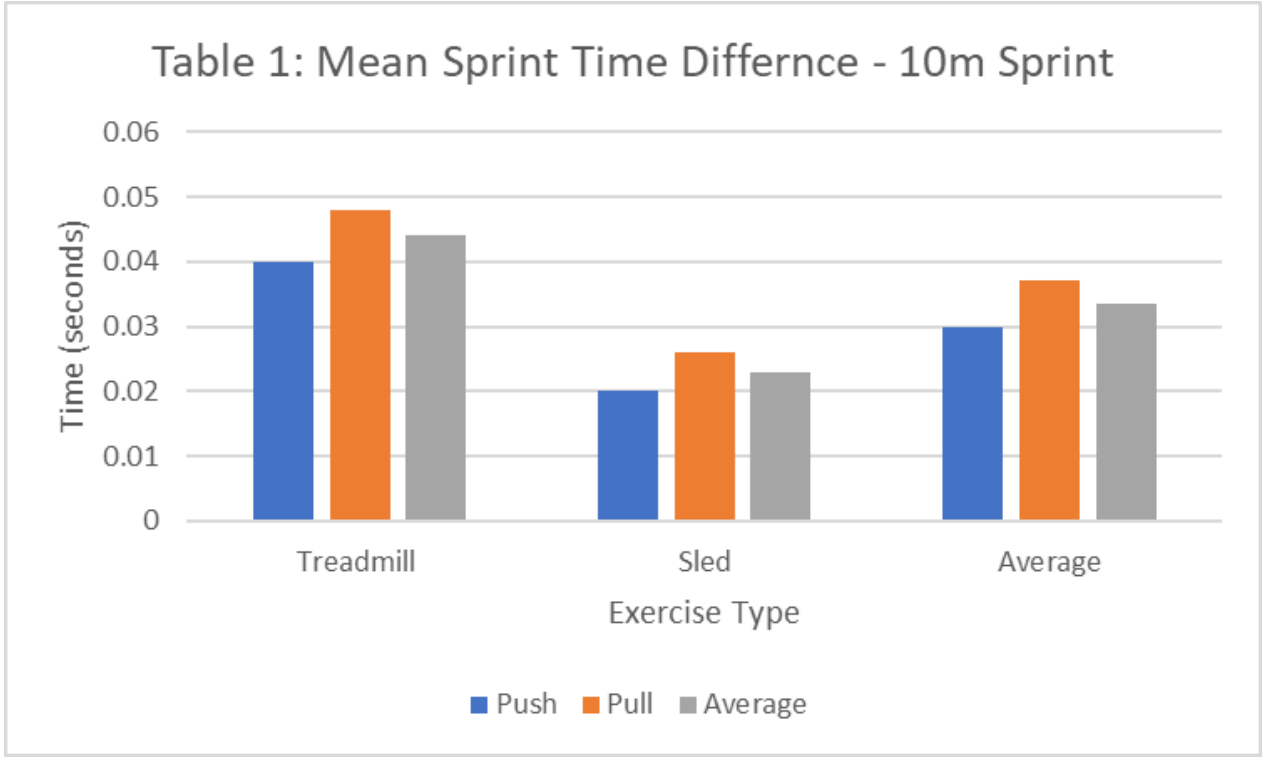
- Is advantageous to weighted sleds or other resisted running, because intensities and loads can be more closely monitored and controlled

Self-Propelled, Resisted Treadmill Training

- How does it work?
  - Matrix S-Drive Performance Trainer
    - Electromagnetic resistor on the running belt (up to 70 lbs. resistance)
    - Clamp resistor on the running belt (up to 300 lbs. resistance)

Self-Propelled, Resisted Treadmill Training

- Unresearched – we are presently beginning a study to investigate this training method



From Bucciarelli et al., expected 2020

High Speed/ High Incline Treadmill Training

- Is an alternative method of resisted AND assisted running training
  - **Proven** to be effective in improving speed, power, and recovery in soccer players
    - Bucciarelli et al., 2015 (published in International Research in Science and Soccer II)
    - Srbely, Linde, Bucciarelli, 2015 (presented at 5th World Conference on Science and Soccer, Rennes, France)

High Speed/ High Incline Treadmill Training

- How does it work?
  - Woodway Pro-XL Treadmill
    - High speed
      (up to 15 Mph / 24 Kmph)
    - High Incline (up to 25% grade)
    - Used to perform “hill sprints” while maintaining a high running speed

High Speed/ High Incline Treadmill Training

- What causes improvements in speed/acceleration, and recovery?
  - Our hypothesis: improvements in stride frequency occur by increasing the speed of leg muscle contractions when running

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High Speed/ High Incline Treadmill Training

- Is advantageous to weighted sleds and/or hill training due to increased ability to prescribe, monitor, and adjust workload to athletes
- Allows coaches to focus on coaching!

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High Speed/ High Incline Treadmill Training

- Has been shown to increase activation of specific muscles involved in sprinting, i.e. hamstrings and hip flexors, more than over-ground running
(Swanson & Caldwell, 1999)

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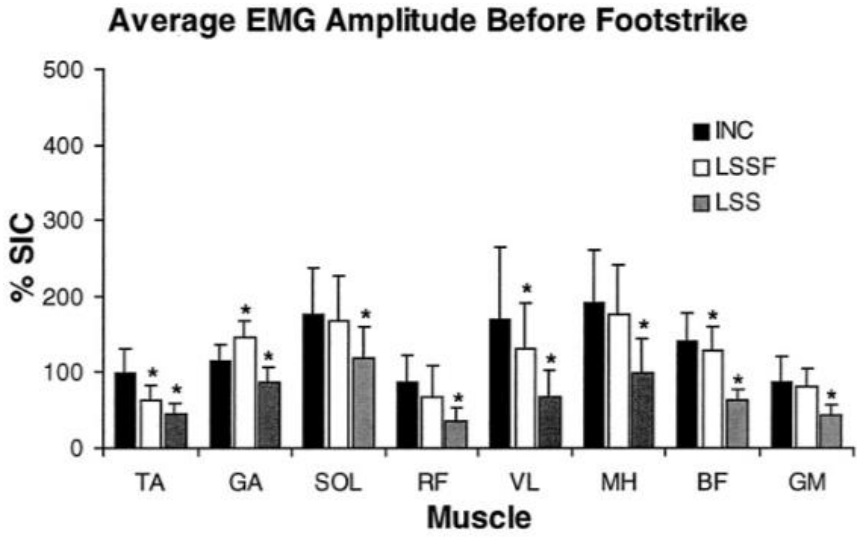
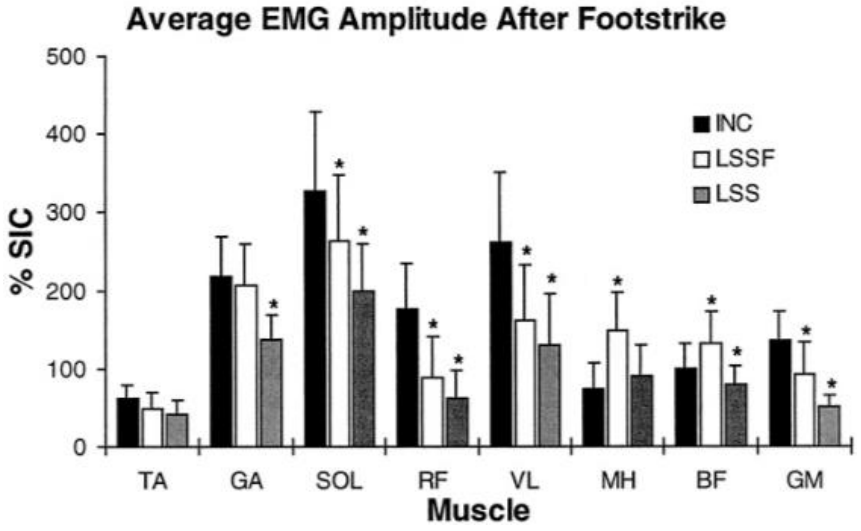
High Speed/ High Incline Treadmill Training

- Specific Conclusions from Swanson & Caldwell (1999):
  - Incline treadmill running elicited significantly greater force from the hip flexor muscles (rectus femoris, vastus lateralis) than level ground treadmill running
  - Mann et al. (1986) have suggested that the main muscle groups that increase the speed of gait were the hip flexors and the knee extensors
  - **Thus, the enhanced muscular loading of the hip flexors that takes place during incline running would be conducive to enhancing running speed**





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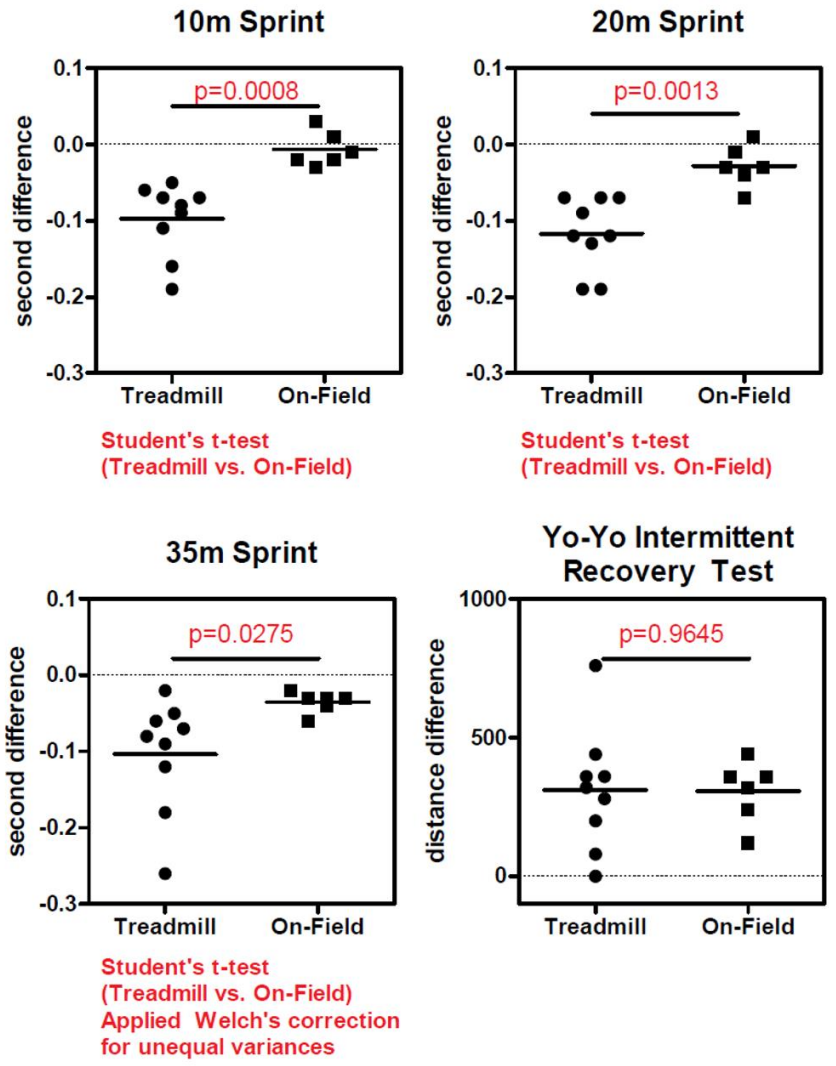
High Speed/ High Incline Treadmill Training

- PROVEN Benefits of High Speed / High Incline Treadmill Training:
  - …Players run faster!
  - …Player recover better!



Q: Is there a change in test performance over time?

Compare differences in each group to a hypothetical value of '0'-- indicating training had no impact on performance.

10m Sprint

Treadmill: p=0.0003 **yes**
On-Field: p=0.507 **no**

20m Sprint

Treadmill: p<0.0001 **yes**
On-Field: p=0.0508 **no**

35m Sprint

Treadmill: p=0.0031 **yes**
On-Field: p=0.0016 **yes**

Yo-Yo Intermittent Recovery Test

Treadmill: p=0.0028 **yes**
On-Field: p=0.0011 **yes**

From Bucciarelli et al., 2015

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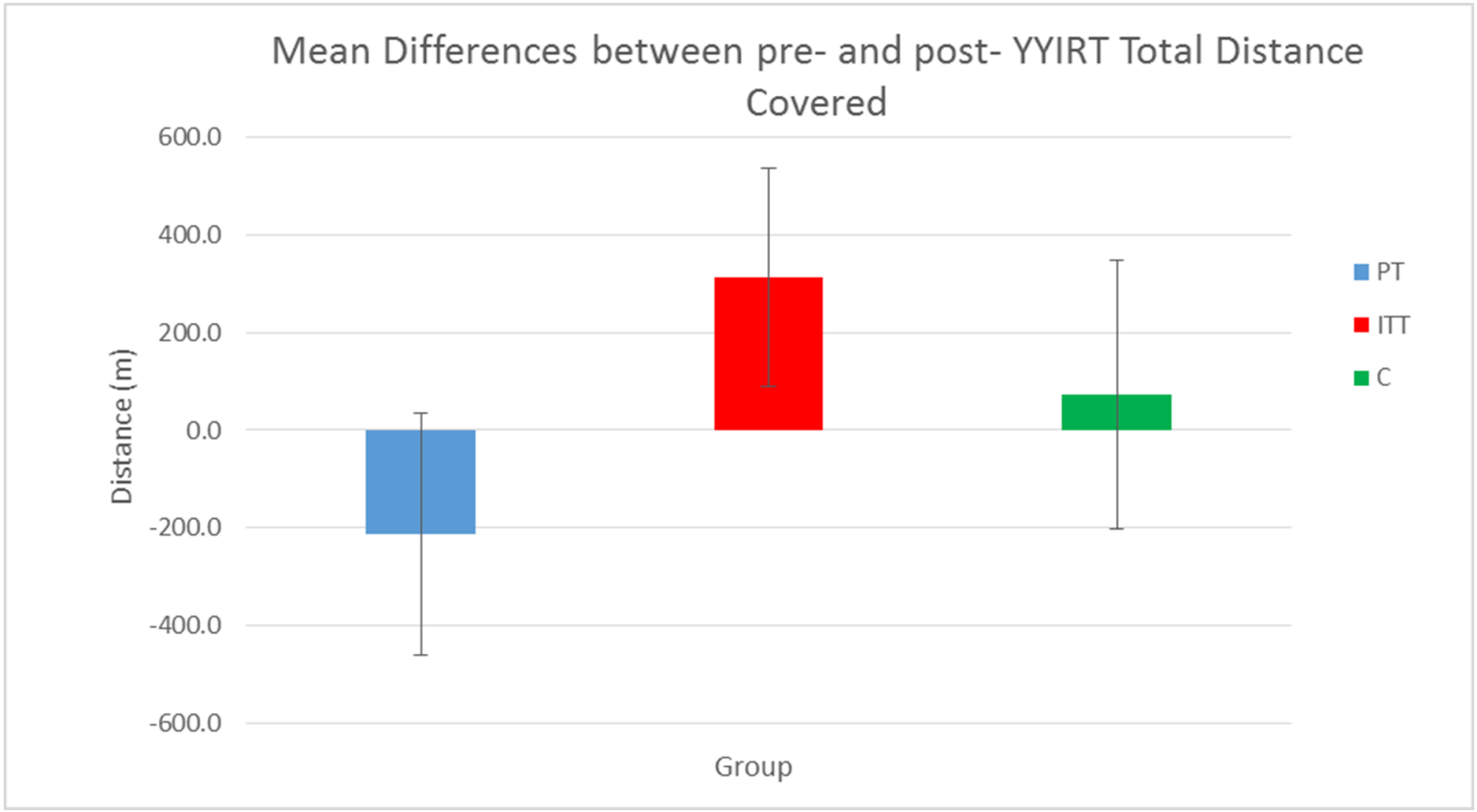
High Speed/ High Incline Treadmill Training

- PROVEN Benefits of High Speed / High Incline Treadmill Training

  …Players recover better!



From Srbely, Linde, Bucciarelli, 2017

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Summary: PROVEN Benefits of Treadmill Training

- Players run ***faster***
- Players jump ***higher***
- Players recover ***better***
- ALL in a **short** time period (6-8 weeks)
- ALL with **minimal** training load (~3-5 minutes running per workout)

Summary: Why Treadmill Training?

- Intensities are higher than what can be achieved on the ground
- Allows for customization of, and seamless progression/increases in workload
- Allows coaches to focus on coaching and correcting mechanics

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Summary: Why Treadmill Training?

- Don’t just take our word for it!

The Future of Speed Training

- Our Research: The Future of Speed Training

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Our Research: The Future of Speed Training

- We know players are running faster, but we don't know **WHY**
- How to find out:
  - 3-D Motion Capture
  - Electromyography
  - Force plates

  …Stay tuned!

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Our Research: The Future of Speed Training

- We also don't know how well they can run **IN A MATCH**
- How to find out:
  - Global Positioning Systems (GPS)
  - Accelerometers
  - Assessed during small- and full-sided matches…Stay tuned!

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The Future of Speed Training

- References

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QUESTIONS?

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