Increasing Exit Velocity Through Technology and Technique

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Exit Velocity is the direct result of the Force Equation in Physics: F=MxA

- **Force = Mass x Acceleration**
- **Sir Isaac Newton was the first Modern Day Hitting Coach**
- **Acceleration in the swing** = Rotation of the player.
- **Mass in the swing** = Barrel of the bat
- **Force** = ***$$$$ Exit Velocity***

Top Five Ways to Increase Exit Velocity

- **Optimize backside balance in the load.**
- **Maintain proper Stack**
- **Create a stable and solid Center of Rotational Axis.**
- **Hit into a firm front side without rollover of the front foot**
- **Maintain connection of the barrel to the ball.**

Overview

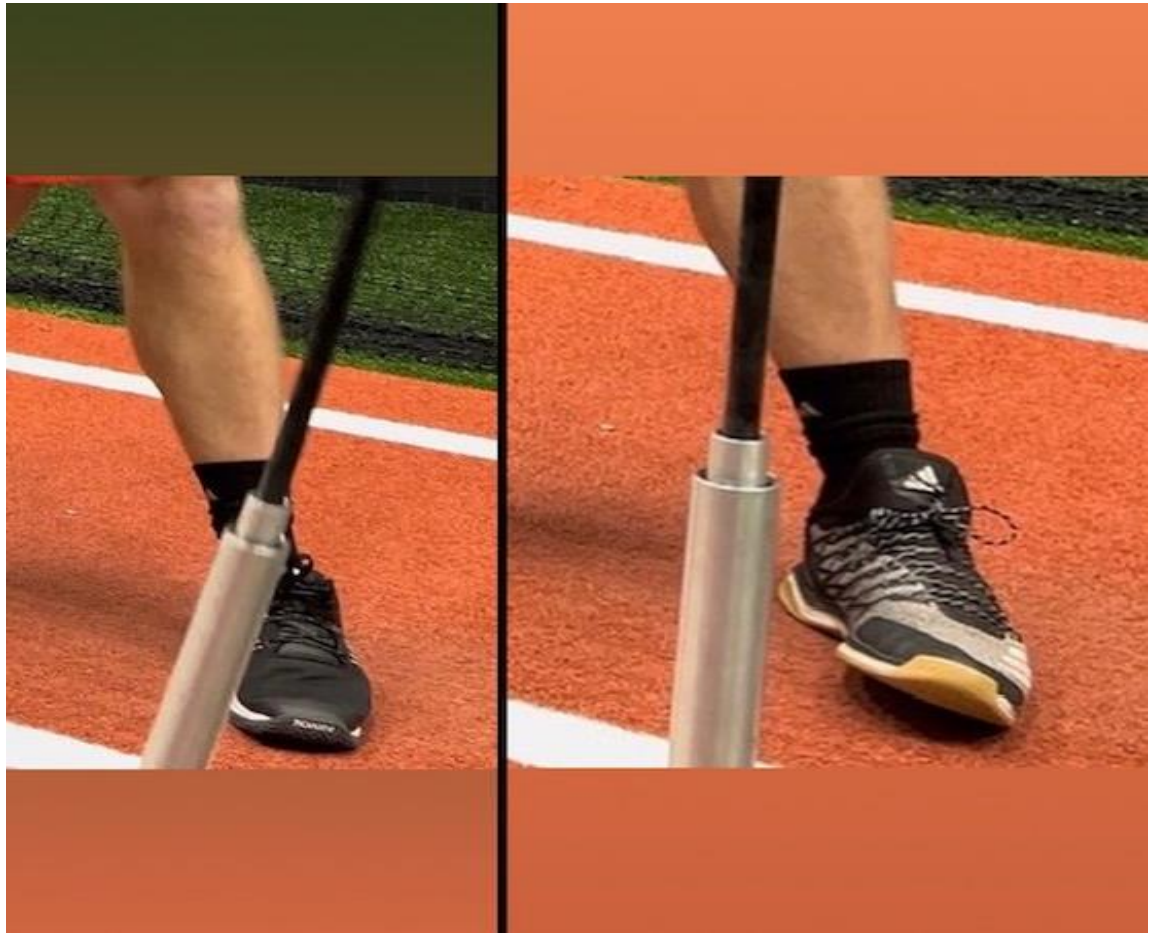
→ **Sqairz has quickly become the leader in scientifically designed sports footwear. Through the initial launch to the latest release of baseball and softball ground force optimizing shoes, Sqairz has cornered the market through patented technology to maximize athlete's performance.**

→ **Athletes can lose up to 11% of Kinetic Energy Transfer on the back foot and up to 8% of energy through the front foot.**

→ **If an athlete does not have proper balance and stability they will spend the majority of the time during their swing compensating to get back on balance.**

→ **Balance establishes Direction, Direction establishes Timing!**

96 mph vs. 86 mph



How Your Foot Works

Your foot is biomechanically a three-legged stool. The stools contact points are:

- The First Metatarsal Head (Big Toe)
- The Calcaneus (Heel)
- Fifth Metatarsal (Pinky Toe)

How Does the Body Produce Rotational Velocity, Generate Energy, and Transfer the Energy to the Ball?

Balance > Direction > Timing

Step 1 - Establish Balance

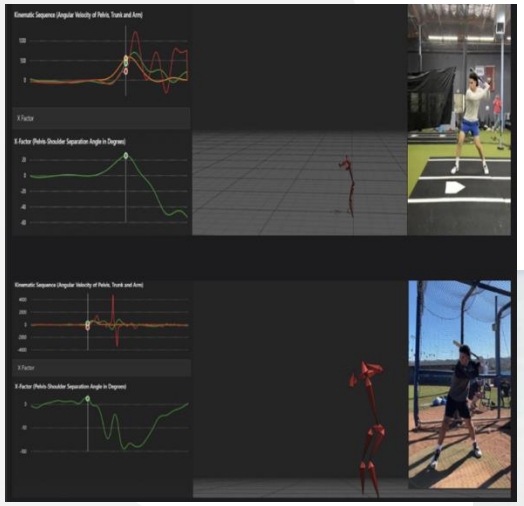
Step 2 - Create of Recoil

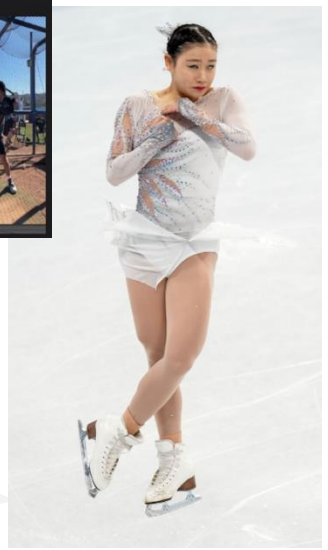
Step 3 - Create a Center of Rotation

Step 4 - Store and Transfer the Energy

Step 5 - Direct the Energy (Force) to the Target

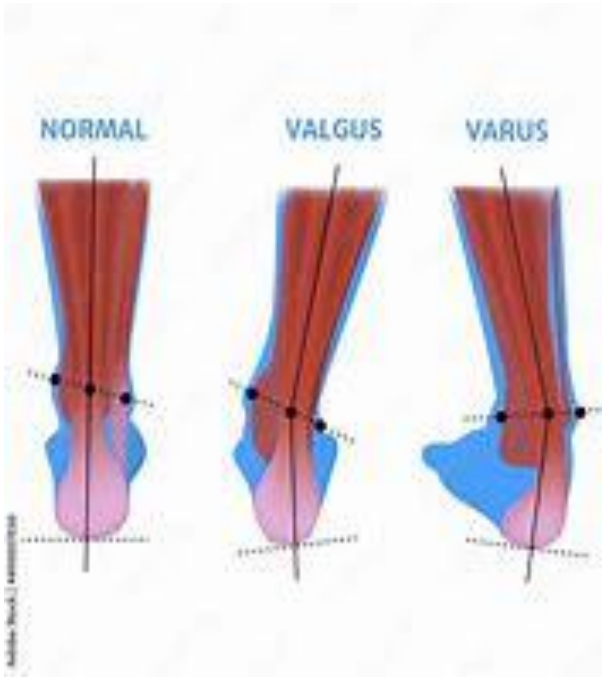
Step 6 - Deliver the Mass consistently through the Zone of Contact (Keep the Barrel attached as long as possible to the Ball)

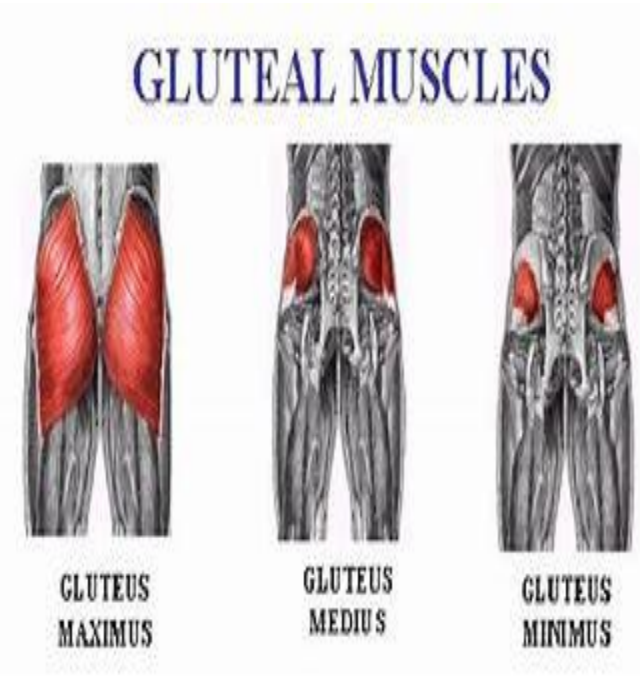




Muscle Engagement and Imbalances

- **Valgus back foot** = Gluteus Minimus Engagement
- **Varus back foot** = Gluteus Medius Engagement
- **Neutral back foot** = Gluteus Maximus Engagement





Improve your vision through your stability!

Kinetisense

Direct Correlation Between Swing and Miss Rate and Balance
Study of Balance Over Time and Field of Gaze

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Overview

Workload management in the baseball industry has been a popular topic of conversation over the past five years. In many situations, teams and organizations are utilizing technology such as Catapult, Whoop, and Polar Straps. Sports Medicine Experts have recently gone to Microdosing prescriptive workouts to mitigate any injuries and attempt to maintain strength.

Recent studies have shown that Microdosing is more detrimental than traditional four day a week in season programming. Strength degradation occurs as early as three days and athletes on microdosing programs have also been shown to have a higher rate of oblique and hamstring issues under higher stress situations. Due to these findings of higher rates of injury due to lack of endurance of the athletes there is a need to fully understand the causality of the injuries in these muscle groups.

By conducting a brief Risk of Fall and Gait study when the athlete arrives in the facility prior to activity the athlete can target and focus on deficiencies to optimize their performance that day. Coaches and trainers can be more aware of the athlete's daily status and objectively observing the athlete's profile over subjectively gaining information. This analysis of how to utilize the Pro Screen AI platform powered by Kinetisense will be the springboard for several new studies on individualized athlete optimization.

Method

This white paper will look at 20 college baseball players that are evaluated in a balance and gait motion capture study utilizing the Pro Screen AI platform powered by Kinetisense. The athletes were measured in a fall risk and gait study prior to participating in performance training session at 7:15 am and then measured again post workout at 12:00 pm. The athletes were then re-revaluated at 4:00 pm after the baseball technique training session.

Observations

Over the course of the study the participating athletes demonstrated a 29% increase in risk of fall and compromised gait between the initial 7:15 am scan the 12:00 pm scan. The athletes then increased an additional 8% of fall risk at the 4:00 pm scan. The total fall risk and gait score increased by a total of 37% over the course of the three scans on average. This means that the athletes participating in this study displayed 37% higher instability scores. The athletes also showed a 2.3 degree variance of eye tilt from the first to the last screening. The athletes also displayed a tendency to tilt to the dominant eye side on the eye level angulation.

Impact on the Athlete

These findings are very important on numerous fronts. The first area that impacts the athlete is that imbalance is one of the leading causes of lower extremity, abdominal, and lower lumbar injuries and days on the disabled list at the professional level. These imbalances can be from numerous reasons, however with the use of the Pro Screen AI platform powered by Kinetisense these issues can be identified early.

The second impact on rotational athletes is the loss of the Center of Rotational Axis (C.O.R.A.). When an athlete loses their C.O.R.A they lose their ability to optimize their rotational velocity throughout the hips, shoulders, and hands. The sequencing of these segments of the body is called the Kinematic Sequence. The Kinematic Sequence is the order of operations of how the body generates and delivers kinetic energy throughout a movement pattern. The establishment C.O.R.A is essential in being able to have a center point or an axis for the body to rotate around. If the body loses that center of rotation, then the body must compensate to regain balance to prevent the athlete as they rotate from falling or completing the activity at hand. This can lead to the athletes putting themselves in a position of vulnerability during the activity and lead to an increase in injury and poor performance. During this initial study the athletes were first tested in balance during gait. When they exhibited an increase in risk of fall they were then analyzed for their efficiency of the Kinematic Sequence. The Kinematic Sequencing study also showed that there is a decrease in efficiency of optimal rotational velocities when the athlete is fatigued.

The third and final area of impact that the Pro Screen AI platform powered by Kinetisense can impact particularly baseball and softball through the understanding of individual balance profiles surround susceptibility of the hitter to off speed pitches with shape later in the game. Hitters that showed display of fatigue tend to have eye level tilt towards their dominant side of 2.3 degrees on average. This is a significant finding due in part to the special recognition and depth perception of a pitch. For example, if a pitcher is throwing a breaking ball with 14 inches of vertical break and the hitter tilts their head by two degrees as the pitch is being delivered this can cause a perceptional miscalculation of an estimated two inches at the point of contact. This is even more apparent in right-hand hitters with right eye dominance and left-hand hitters with left eye dominance because the dominant eye is farther away from the pitcher at the point of release.

Stack and the ability to stabilize from load to land.

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- **Balance is the initial pillar of hitting.**

  Checkpoint

  - Big Toe, Pinky Toe, and Heel
  - Hard Butt vs. Squishy Butt

- **The ability to stay "Stacked" is the ability to be athletic throughout the phases of your swing.**

  Checkpoint

  - Shoulder over Hip
  - Hip over Knee
  - Knee over Ankle

- **If you can maintain stability, you can optimize your rotational velocity.**

  Checkpoint

  - Chin over Belly Button (CORA – Center of Rotation)

- **Postural Control**

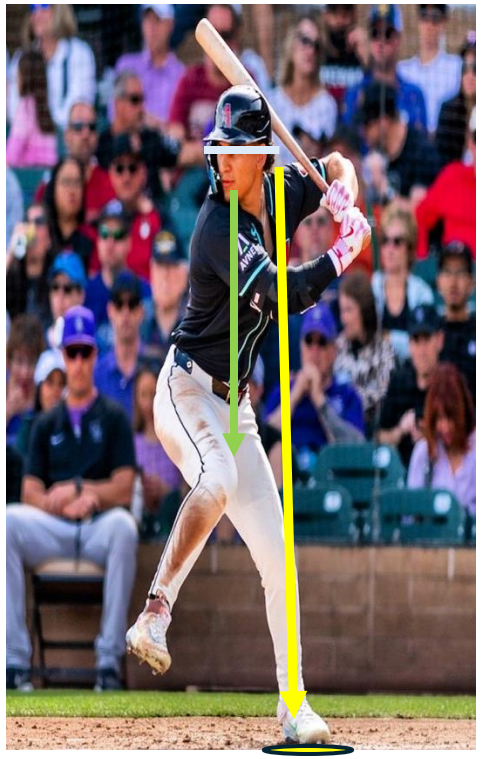
  Checkpoint

  - Chin over Belly Button

- **The Roll of Your Eyes in relation to Posture**

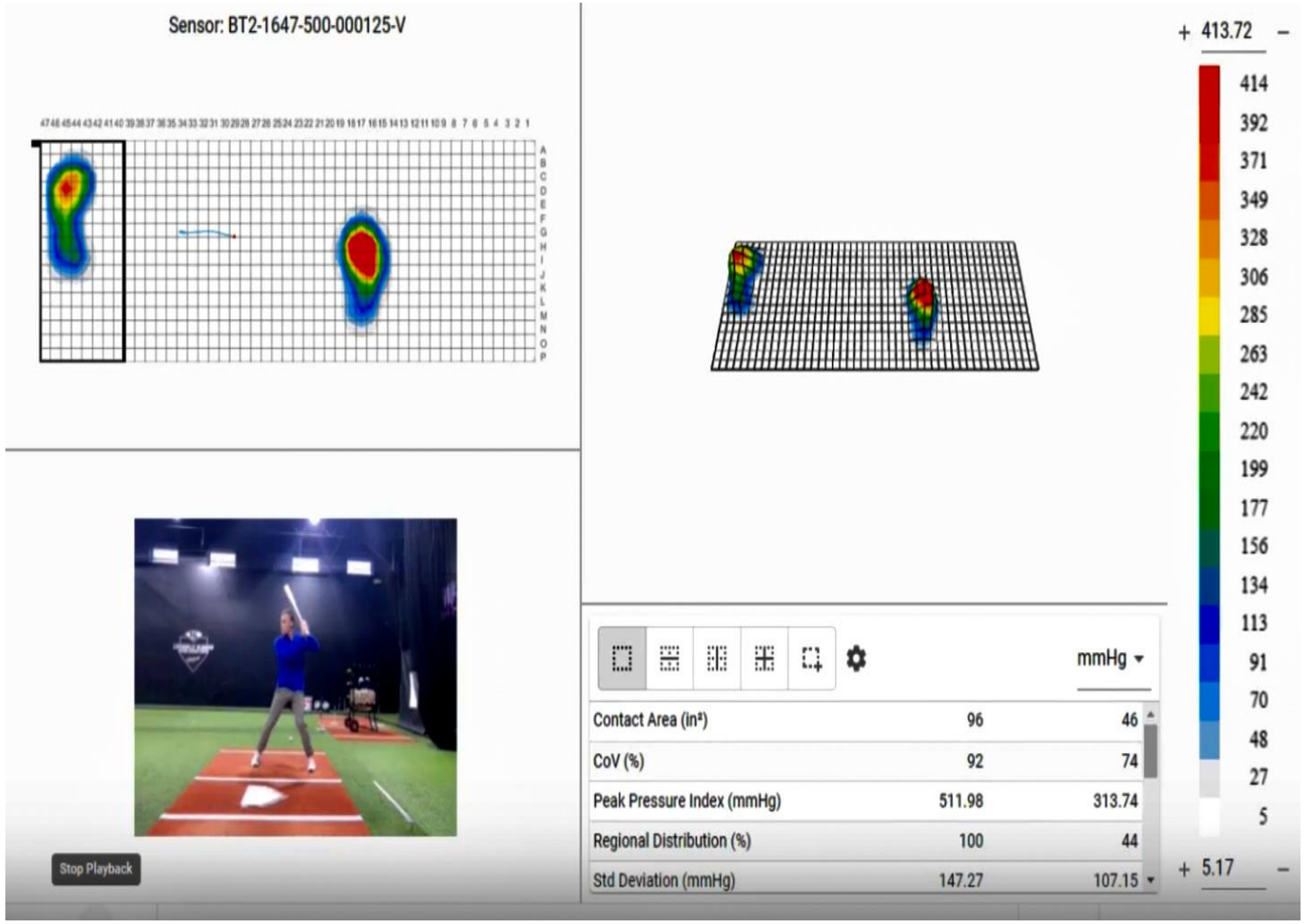
  Checkpoint

  - Horizontal vs. Parallel Eyes



Addressing the Leak Points

- In a 2022 Study, over 350 athletes were tested at the Louisville Slugger Hitting Science Center. The following leak points were consistently addressed in the swing:
- - Up to 11% of Kinetic Energy is lost through inefficient back leg loading patterns
- Up to 8% of Kinetic Energy is lost through an unstable front foot.



Directional Issues are a by product of compensation for imbalance.

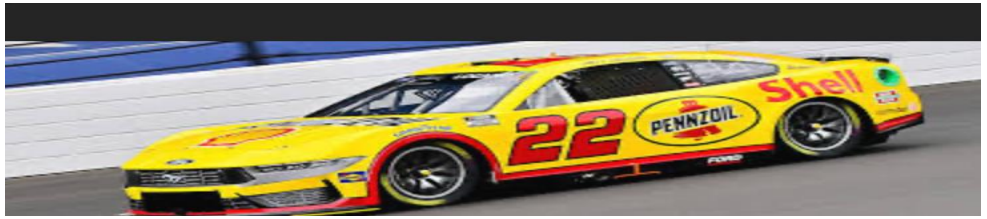
- If the player's balance is off then their direction is off. Directional issues are a by product of imbalance in the players swing.
- Front foot and front hip directional issues will lead to a decrease in the amount of Mass.
- Players that tend to pull out of the zone of contact early will tend to have the greatest increases in Exit Velocity.

How does the front foot impact Exit Velocity?

Delivering Mass Efficiently

How is your swing a sports car?

- **The back leg is the gas pedal, the front leg is the brake pedal.**
- **Your core is the frame of the car.**
- **The lead arm is the engine and the back hand is the steering**



Common Directional Issues – Problem, Root, and Solution

Common Compensatory Directional Issues	Causality	Impact on the Player	Corrective
Front Side Premature Opening	Valgus Front foot and hip impingement	High Top Spin Rates and Loss of Exit Velocity	Resistant Bat Drill
Back Side Collapse	Cervical Mobility, Loss of stack, Stuck in Load	High Swing and Miss,	Resistant Bat Drill and Rev. Pull Giant Band
Loss of Hip Shoulder Separation/ Rushed Sequence	Back Foot Stability, Poor Hand Load, Front Foot Stability, Loss/ Lack of Stretch	Loss of Power, Rotational, Poor Ball Flight	Reverse Phase Sequencing Drill Series
Loss of Center of Mass - AKA Crash Hitting	Poor Rear Foot Stability, Weak Core, Poor Vision, Valgus Back Foot	Loss of Power, Reduction of Zone Coverage, High Swing and Miss	Hard Butt Sequishy Butt, Rev and Forward Pull
Casting	Poor back foot balance, front hip opens before back	Loss of Power, Rotational, Reduction of Zone Coverage	Center of Mass Drill, Long Bat, Front Arm
Pushing	Valgus Back Foot, Loss of Center of Mass, Poor Back side Hip ROM	Loss of Power, Lack of Hand Speed	Hard Butt Sequishy Butt, Rev and Forward Pull
Top Spin	Top Half Dominance, Front Foot Stability, Trying to Manufacturer Launch	Loss of Power, Loss of Carry, and High Ground Ball Rate	3D Strap Cable, Hockey Tee Drill

Basic Screening – Things that you need to Understand About Your Player before Coaching.

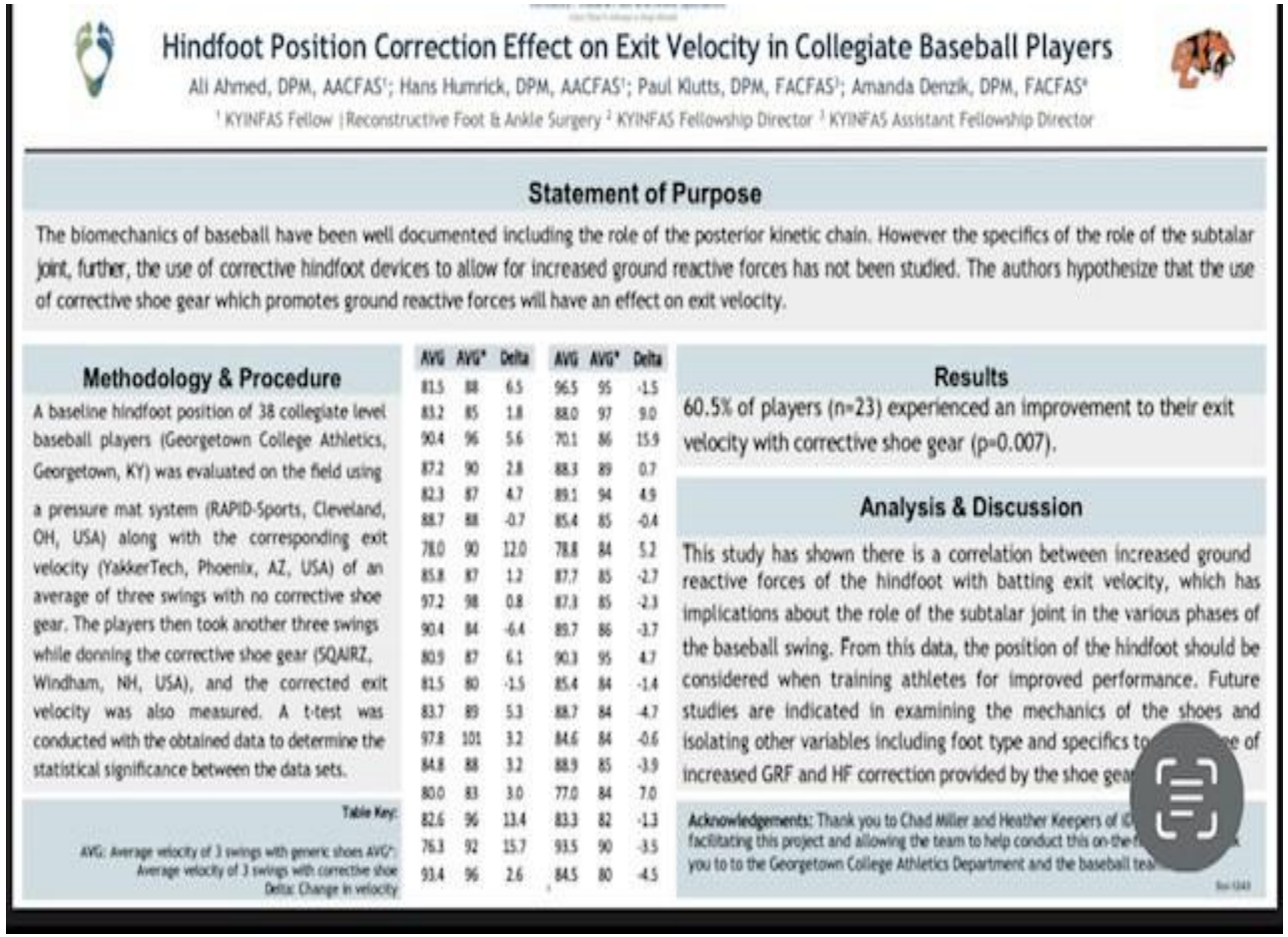
- How does your player identify and understand this base?
- What type of unique anatomical challenges does your players possess?
- What is your Player's SWOT?
- How does your player move?
- What is your Player's Center of Rotational Axis (Center of Gravity)?

DIAMOND SPORTS

The Role of Equipment in Your Pursuit of Exit Velocity

ACFAS Study

- Sqairz is the first ever baseball performance shoe to be presented at the American College of Foot and Ankle Surgeons Annual Scientific Conference.
- **60.5%** of the players that put the shoe on without any additional coaching or instruction saw an increase in exit velocity.
- This increase in exit velocity was attributed to the players being able to establish better balance and stability due to the construction and design of the shoe.



Hindfoot Position Correction Effect on Exit Velocity in Collegiate Baseball Players

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Statement of Purpose

The biomechanics of baseball have been well documented including the role of the posterior kinetic chain. However the specifics of the role of the subtalar joint, further, the use of corrective hindfoot devices to allow for increased ground reactive forces has not been studied. The authors hypothesize that the use of corrective shoe gear which promotes ground reactive forces will have an effect on exit velocity.

Methodology & Procedure

A baseline hindfoot position of 38 collegiate level baseball players (Georgetown College Athletics, Georgetown, KY) was evaluated on the field using a pressure mat system (RAPID-Sports, Cleveland, OH, USA) along with the corresponding exit velocity (YakkerTech, Phoenix, AZ, USA) of an average of three swings with no corrective shoe gear. The players then took another three swings while donning the corrective shoe gear (SQAIRZ, Windham, NH, USA), and the corrected exit velocity was also measured. A t-test was conducted with the obtained data to determine the statistical significance between the data sets.

Table Key:

AVG: Average velocity of 3 swings with generic shoes AVG*: Average velocity of 3 swings with corrective shoe Delta: Change in velocity

AVG	AVG*	Delta	AVG	AVG*	Delta
81.5	88	6.5	96.5	95	-1.5
83.2	85	1.8	88.0	97	9.0
90.4	96	5.6	70.1	86	15.9
87.2	90	2.8	88.3	89	0.7
82.3	87	4.7	89.1	94	4.9
88.7	88	-0.7	85.4	85	-0.4
78.0	90	12.0	78.8	84	5.2
85.8	87	1.2	87.7	85	-2.7
97.2	98	0.8	87.3	85	-2.3
90.4	84	-6.4	89.7	86	-3.7
80.9	87	6.1	90.3	95	4.7
81.5	80	-1.5	85.4	84	-1.4
83.7	89	5.3	88.7	84	-4.7
97.8	101	3.2	84.6	84	-0.6
84.8	88	3.2	88.9	85	-3.9
80.0	83	3.0	77.0	84	7.0
82.6	96	13.4	83.3	82	-1.3
76.3	92	15.7	93.5	90	-3.5
93.4	96	2.6	84.5	80	-4.5

Results

60.5% of players (n=23) experienced an improvement to their exit velocity with corrective shoe gear (p=0.007).

Analysis & Discussion

This study has shown there is a correlation between increased ground reactive forces of the hindfoot with batting exit velocity, which has implications about the role of the subtalar joint in the various phases of the baseball swing. From this data, the position of the hindfoot should be considered when training athletes for improved performance. Future studies are indicated in examining the mechanics of the shoes and isolating other variables including foot type and specifics to [illegible] of increased GRF and HF correction provided by the shoe gear.

Acknowledgements: Thank you to Chad Miller and Heather Keepers of [illegible] facilitating this project and allowing the team to help conduct this on-the-[illegible] you to to the Georgetown College Athletics Department and the baseball team.

Summary

- **Optimization of Exit Velocity is a function of the player's body moving well.**
- **The players anatomy will dictate what exit velocity that they can achieve.**
- **The more efficient a player can move the higher the Exit Velocity that they can achieve.**
- **Proper Balance, Direction, and Timing will yield the highest Exit Velocities.**
- **85% of all swing issues can be solved for in a weight room and not a cage!**

Thank YOU!

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